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# JOURNAL

OF

## THE CHEMICAL SOCIETY.

### ABSTRACTS OF PAPERS

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1905. Vol. LXXXVIII. Part II.

LONDON :

GURNEY & JACKSON, 10, PATERNOSTER ROW.  
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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN  
BRITISH AND FOREIGN JOURNALS.

### PART II.

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#### General and Physical Chemistry.

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**Optical Reflection Constants and the Electromotive Condition of Chromium.** AUGUST L. BERNOULLI (*Chem. Centr.*, 1904, ii, 1371; from *Physikal. Zeit.*, 5, 632—634).—An optical examination of chromium which had been rendered passive by exposure to air or by a boiling solution of *p*-benzoquinone in benzene has been made by Michéli's method (*Abstr.*, 1901, ii, 82). The results showed that the metal was coated with a superficial layer. The composition of this layer is, according to the author,  $2\text{Cr}_2\text{O}_3\cdot\text{CrO}_3$ . The maximum change of *E.M.F.* against an electrode of platinum in a solution of ammonium nitrate was found to be 0.35 volt. When the metal is made passive by the action of nitric acid, the alteration of *E.M.F.* is much greater and may reach 0.9 volt. Oxygen and nitric oxide are both absorbed by chromium, and the metal, which had been treated with nitric acid and thoroughly washed, was found to liberate a measurable quantity of nitric oxide when allowed to remain in water for several hours; active chromium does not yield this gas under similar conditions.

E. W. W.

**The Stereochemistry of Nitrogen.** HUMPHREY O. JONES (*Brit. Assoc. Reports*, 1904, 1—24).—This report contains a review of the state of knowledge respecting the stereochemistry of nitrogen. An account



is given of the researches on tervalent nitrogen compounds, including substituted ammonias, cyclic compounds, oximes, hydrazones and semicarbazones, anils, and azo-compounds; and also of the quinquivalent nitrogen compounds and their optical activity. This is followed by a discussion of the various molecular configurations which have been proposed to account for the facts. Full references to the literature are given.

C. H. D.

**Racemism.** GIUSEPPE BRUNI and F. FINZI (*Atti R. Accad. Lincei*, 1904, [v], 13, ii, 349—355).—The method given by Bruni (Abstr., 1900, ii, 269) for determining whether an optically inactive substance is a racemic or pseudoracemic compound or a mixture has been since applied by Adriani (Abstr., 1901, ii, 230) and by Smits (Abstr., 1903, i, 263) to certain definite cases. The authors now give more complete considerations concerning this method. Instead of the method of fusion, they use that of solidification with the thermometer immersed in the fused mass, which gives far more exact results and entirely avoids the errors indicated by Smits. The determination of the freezing temperatures of cryohydrates by means of the Beckmann apparatus requires, in general, larger quantities of substance than the fusion method, but with a suitable solvent which dissolves only small proportions of the isomerides a few decigrams are sufficient. Besides the inactive substance, only one active compound is required, and of this the cryohydric temperature is determined. The composition of the solution is found either by analysis or by extrapolation of the freezing curve. Increasing amounts of the *d*- or *l*-compound are then added to the cryohydrate solution of the inactive compound. If the isomerides form a simple conglomerate, the freezing point remains constant and the solution inactive. Where a true racemic compound exists, the freezing temperature falls to a certain point; further additions do not change it or the rotation of the supernatant solution. By weighing the dry residue and determining its rotatory power, the amounts of inactive and active substances can be arrived at and the equilibrium curves drawn. These vary in form according as the compound or the components are the more soluble. Where pseudo-racemic mixed crystals are formed, every fresh addition alters both the freezing point and rotatory power, no invariant point being attained. Curves are given, according to Schreinemakers' method of representation (Abstr., 1893, ii, 260 and 512), for all the possible cases.

The compounds investigated by the authors are methyl diacetyl-tartrate and methyl diacetylracemate in ethylene bromide and *p*-xylene and ammonium hydrogen racemate and tartrate in water. With the first pair of compounds the racemic ester is the more soluble, and with the second pair the tartrate. In both cases, true racemic compounds are formed.

T. H. P.

**Flame Spectra.** CHARLES DE WATTEVILLE (*Phil. Trans.*, 1904, A., 204, 139—168. Compare Abstr., 1904, ii, 222).—By injecting the spray from saline solutions into the gas to be burned, Gouy discovered (in 1879) several new lines in the flame spectra belonging to the metals contained in the solutions, but emitted only in the vicinity of

the blue inner cone. The author, extending Gouy's observations, has studied photographically a large number of flame spectra, including the ultra-violet portions. The method employed for the production of the flame is, with slight modifications, the same as that devised by Gouy. Recorded lines are fully tabulated for lithium, sodium, potassium, magnesium, calcium, strontium, barium, zinc, cadmium, silver, copper, tin, lead, bismuth, chromium, iron, nickel, and cobalt. It is shown that there are many more lines in the spectra obtained by the author's method than is the case when the salt spray is not previously mixed with the gases which react to form the flame. As a rule, the lines which are found in the flame spectrum are those which are the strongest lines in the arc spectrum. On the other hand, none of the characteristic lines of the spark spectrum are ever seen in the flame spectrum. There is, however, a very marked resemblance between the flame spectrum and that of an oscillatory spark. This is especially the case with iron, nickel, and cobalt.

J. C. P.

**Chemical Effects of Light. Action of Hydrochloric Acid on Platinum and Gold.** MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1904, [viii], 3, 295—299).—A *résumé* of work already published (Abstr., 1904, ii, 569).

M. A. W.

**Emanations and Radiations.** MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1904, [viii], 3, 289—293).—A theoretical discussion of which a notice has already appeared (Abstr., 1904, ii, 602).

M. A. W.

**Genesis of Temporary Radioactivity.** ED. SARASIN, THOMAS TOMMASINA, and F. JULES MICHELI (*Compt. rend.*, 1904, 139, 917—920).—The curves representing the rate of fall of the radioactivity induced on negatively charged metallic wires exposed to the air resemble the curves for the activity induced by exposure to radioactive substances. The rate of decay of activity is the same for silver, copper, aluminium, iron, and nickel whether the metals have been exposed to ordinary air or to air ionised by X-rays. The activity induced by the X-rays is not due to direct radiation, but to the ionisation which these produce in the air.

If the electroscope employed for the measurements is positively charged in one experiment and negatively in a second experiment, the curves representing decay are not superposable. The explanation of this seems to be that the induced activity emits two kinds of oppositely charged particles ( $\alpha$  and  $\beta$ ) which behave differently in the electroscopic apparatus in consequence of their different velocities. Experiments on the decay of the feeble activity induced on exposed wires, which are positively charged, confirm this supposition.

The observations lead to the view that the production of induced radioactivity consists in the absorption of an emanation which is formed when gases are ionised; this absorbed or adherent emanation gradually disappears in consequence of radiation, and a corresponding fall in activity is observed.

H. M. D.



**Secondary Radiation caused by the  $\beta$ - and  $\gamma$ -Rays of Radium.** A. S. EVE (*Phil. Mag.*, 1904, [vi], 8, 669—685).—An electroscope screened from the glass tube containing the radium by means of a thick lead screen was exposed to the action of the secondary radiations caused by the action of the  $\beta$ - and  $\gamma$ -rays on various radiators. A large number of substances were employed as radiators, and although the secondary radiation is generally greater for substances of high density, it is not proportional to the density. It was found that the effective depth from which the secondary radiation proceeds varies for different materials; thus for paper the secondary radiation increases until a thickness of about 2 or 3 mm. is reached and then remains constant. A plate of lead placed behind the paper, however, would then cause an increase. By cutting off the primary  $\beta$ -rays it was found that the secondary radiations produced by  $\gamma$ - and  $\beta$ -primary rays are of the same character, and that about 85 per cent. of the secondary radiation is due to the  $\beta$ -rays. This was also confirmed by deflecting the  $\beta$ -rays by a magnetic field. The secondary rays are, however, different from those caused by the Röntgen rays, the latter having far greater penetrative power. The absorption of the radium secondary radiations was found to obey accurately the simple exponential equation  $I = I_0 e^{-\mu x}$ , and the radiations hence appear more homogeneous than the primary rays; the absorptive power of different materials is roughly in the order of their densities. The radiation from the surface when the primary rays passed through from the back was also investigated; the curve increases with thickness to a maximum, remains approximately constant, and then falls, and this is the type of curve deduced theoretically, namely, that corresponding with the difference between two simple exponential curves.

The secondary radiations produced by the  $\gamma$ -rays can be deflected by a magnetic field and it has been shown by Becquerel that the  $\beta$ -secondary rays are deviable, so that the  $\beta$ -,  $\gamma$ -, and Röntgen secondary radiations all consist of electrified particles. The author does not consider that there is any evidence that the  $\gamma$ -rays are negatively electrified, they are probably unchanged particles or are of the type of Röntgen rays (compare Paschen, *Abstr.*, 1904, ii, 461). It seems reasonable to suppose that the expulsion of the  $\beta$ -particles must be accompanied by pulses similar to those set up by the stoppage of the cathode particles, and that these pulses, analogous to the Röntgen rays, constitute the  $\gamma$ -rays.

L. M. J.

**Absorption of  $\alpha$ -Rays and the Classification of the  $\alpha$ -Rays from Radium.** W. H. BRAGG (*Phil. Mag.*, 1904, [vi], 8, 719—725).—The author seeks to explain various differences in the absorption phenomena of  $\alpha$ - and  $\beta$ -rays by the hypothesis that the  $\beta$ -rays are liable to deflexion through collision, but the  $\alpha$ -rays are not. Reasons for the probability of this being the case are given, based on the difference in magnitude of the  $\alpha$ - and  $\beta$ -particles, and in support of the hypothesis the facts are brought forward that there is no scattered or secondary radiation in the case of the  $\alpha$ -rays, and that a stream of  $\alpha$ -rays is as sharply defined after passage through a screen as before. Since the  $\alpha$ -rays lose energy solely by ionisation, they will reach a



distance proportional to the initial energy, and an ionisation chamber is unaffected if just out of range. The author has investigated the latter case to determine the curve obtained when the ionisation chamber is brought nearer. The effect expected was that when out of range of  $\alpha$ -rays an effect due to  $\beta$ - and  $\gamma$ -rays would be obtained; when the  $\alpha$ -rays just penetrate there would be a sudden appearance of ionisation which, for a distance equal to the depth of the chamber, should give a parabolic curve, afterwards a straight line. This effect was actually obtained, but in addition it was found that, as the radium is brought nearer to the chamber, there are two or three sudden changes of direction of the line, the final slope being about four times the initial. The author suggests the explanation that there are several changes, and at four of these an  $\alpha$ -atom is expelled, so that there are four different streams of  $\alpha$ -particles differing in initial energy (Rutherford, Abstr., 1904, ii, 223).

L. M. J.

**Ionisation Curves of Radium.** W. H. BRAGG and R. KLEEMAN (*Phil. Mag.*, 1904, [vi], 8, 726—738).—The ionisation in a shallow chamber brought closer to a source of  $\alpha$ -rays, limited to a narrow cone, increases, yielding a straight line curve, for as the distance diminishes the curve includes  $\alpha$ -rays from deeper and deeper strata in the radium. If, however, the layer is sufficiently thin, so that  $\alpha$ -particles emerge from the lowest layers, the curve should yield a straight line terminated by a vertical portion representing the range of the particles from the lowest layer. The layers employed were obtained by evaporation of a few drops of a solution of radium bromide. The curves obtained approximate to the expected form for such a curve as indicated above, with the addition that there are four different sets of rays. The curve consists of a straight portion which curves almost vertically downwards at three points; the various portions of the curve are lettered *P*, *Q*, *R*, and *S*. If the dish is raised to a red heat, the portions *Q* and *R* disappear, so that these probably represent rays from the emanation and first induced activity, and as *P* subsequently decays it represents rays from the last induced activity; these last rays penetrate about twice as far and give rise to twice the ionisation. Although not established, it seems probable that *R* represents the effect of the emanation. In the curves there is noticeable a return towards the vertical axis in the lower portions of *P* and *S*, indicating apparently that the  $\alpha$ -particle is more effective at the end of its course. The experiment recorded in the previous abstract was repeated with a spherical ionisation chamber, by which the separate lines referred to were more clearly obtained. The authors also give an explanation of Becquerel's observation that the curvature of a thin sheet of  $\alpha$ -rays, when deflected by a magnet, was less at greater distances from the source.

L. M. J.

**Chemical Composition of the Radioactive Gaseous Mixtures evolved from the Waters of Thermal Springs. Presence of Helium.** CHARLES MOUREU (*Compt. rend.*, 1904, 139, 852—855. Compare Moissan, Abstr., 1903, ii, 209; Nasini, Abstr., 1904, ii, 399; Curie and Laborde, *ibid.*, ii, 461).—The author has examined the

radioactive gases obtained from thirteen thermal springs, and finds that after the nitrogen and oxygen have been absorbed by a mixture of lime and magnesium at a red heat (compare Maquenne, *Abstr.*, 1896, ii, 299) a residue is obtained, varying in quantity from 0.50 to 2.11 per cent. of the original volume, and presenting the characteristic spectra of argon and helium. M. A. W.

**A Radioactive Gas in the Wiesbaden Thermal Springs.** FERDINAND HENRICH (*Zeit. angew. Chem.*, 1904, 17, 1757—1760).—The gas obtained from the Adler and Schützenhof springs, Wiesbaden, after being separated from carbon dioxide and hydrogen sulphide, affected a photographic plate. The radioactivity of the gas was also examined electrometrically.

The water of the springs is also radioactive, but becomes practically inactive when boiled. A. McK.

**Demonstration of  $n$ -Rays.** H. BORDIER (*Compt. rend.*, 1904, 139, 972—974. Compare Rothé, *Abstr.*, 1904, ii, 603, and Blondlot, *ibid.*, 604).—Drops of collodion containing calcium sulphide in suspension are deposited in two groups on a piece of paper; after drying and keeping in the dark for 12 hours, the sulphide is made phosphorescent by exposure to daylight for a few minutes and the paper placed face downward on a photographic plate, a source of  $n$ -rays in the shape of a file of tempered steel or steel shot being placed over one group of spots and a piece of lead of similar size and shape over the other group. On developing the plate after 24 hours' exposure, each spot is represented on the negative by a very black spot surrounded by a penumbra, but the penumbrae which surround the spots corresponding with the steel extend farther than those corresponding with the lead, as the following measurements, made independently by M. Louis of the Lyons University, show :

	Diameter (mean)	
	of spot.	of penumbra.
Spots (exposed to steel).....	6.4 mm.	11.7 mm.
Spots ( „ „ lead) .....	7.1 „	10.8 „

It follows therefore that the tempered steel emits  $n$ -rays, which increase the phosphorescence of the calcium sulphide. M. A. W.

**Transition Resistance and Polarisation at the Aluminium Anode.** FRANZ FISCHER (*Zeit. Elektrochem.*, 1904, 10, 869—877).—An aluminium anode in a solution of sulphuric acid of sp. gr. 1.175 is studied. When the anode is a wire of 2 mm. diameter, its resistance breaks down between 22 and 27 volts. A tube was then tried, the bulb of a thermometer being placed inside it; at about 18 volts, the temperature within the tube had risen to 109°, the electrolyte boiled in contact with it, and the resistance broke down. By using a water-cooled tube as anode, it was possible to raise the voltage to over 200 without a breakdown of the resistance (see also *Abstr.*, 1903, ii, 587). In all cases a distinct film was formed on the anode, and when the

applied *E.M.F.* was increased the current passing increased also, thereafter gradually decreasing to a value which, for a given electrode area, is practically independent of the *E.M.F.*

The greater part of the great fall of potential between the anode and the electrolyte is shown to be due to the low conductivity of the film which forms on the anode and which therefore acts as a condenser.

The thickness of the film formed was measured by means of a microscope and was found to increase in proportion to the potential difference between the electrode and the solution. The thickness with 12 volts was 0.048 mm., with 24 volts 0.105 mm., with 36 volts 0.145 mm., and with 72 volts 0.29 mm.

These observations are satisfactorily explained by supposing that the film grows in thickness until the current which the applied *E.M.F.* can produce is just sufficient to renew it at the same speed as it is dissolved by the sulphuric acid; as the rate of dissolution is constant for a given electrode area, the final current must be independent of the applied *E.M.F.*, as was found to be the case. The formation of the film may be assisted by the fact that alumina, when suspended in aqueous solutions through which a current is passing, always moves towards the anode.

T. E.

**Employment of Alternating Currents in Chemistry and the Theory of the Reactions which they determine.** MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1904, [viii], 3, 300—305).—A résumé of work already published (Abstr., 1904, ii, 465).

M. A. W.

**Electrolysis by Alternating Currents.** ANDRÉ BROCHET and JOSEPH PETIT (*Ann. Chim. Phys.*, 1904, [viii], 3, 433—499).—A résumé of work already published (compare Abstr., 1904, ii, 229, 230, 414; this vol., ii, 27, 28).

M. A. W.

**Theory of the Deposition of Metals from rapidly moving Electrolytes.** RICHARD AMBERG (*Zeit. Elektrochem.*, 1904, 10, 853—855).—The favourable effects of rapid stirring in electrolytic estimations of metals are, qualitatively, capable of explanation by means of Nernst's theory of reaction velocity in heterogeneous systems (Abstr., 1904, ii, 315).

T. E.

**Genesis of Ions by the Motion of Positive Ions and a Theory of the Sparking Potential.** JOHN S. TOWNSEND and H. E. HURST (*Phil. Mag.*, 1904, [vi], 8, 738—752).—If a number of ions,  $n_0$ , are set free by the action of ultra-violet light from the negative electrode in a gas and travel in a uniform field to the positive electrode, the total number of ions ( $n$ ) which arrive is given by the formula:  $n = n_0(a - \beta)e^{(a - \beta)d} / (a - \beta e^{(a - \beta)d})$ , where  $a$  is the number of molecules ionised by a negative ion in going through 1 cm. of the gas,  $\beta$  the corresponding number for the positive ion, and  $d$  the distance between the parallel electrodes. The values of  $a$  and  $\beta$  for given values of pressure  $p$  and electric force  $X$  may be deduced from determination of currents for different values of  $d$  when  $p$  and  $X$  are constant. If



$\alpha = \beta e^{(\alpha - \beta)l}$ , that is,  $d = A = (\log \alpha - \log \beta) / (\alpha - \beta)$ , then  $n$  becomes infinite and  $X \times A$  gives the sparking potential. The values  $X \times A$  are thus calculated for air and hydrogen at pressures 2 mm., 4 mm., 6 mm., and 8 mm., and compared with the sparking potential determined experimentally; the agreement is very close, being within about 0.5 per cent. in the case of air, and about 1 per cent. in the case of hydrogen. The values found for  $\alpha$  and  $\beta$  show that the positive ions in hydrogen are more active in producing ionisation than the positive ions in air. An account of experimental precautions is given, and an addendum by Prof. Townsend is added on the potential required to maintain a current in a gas.

L. M. J.

**Diffusion of One Electrolyte in Presence of Another with a Common Ion.** UGO GRASSI (*Gazzetta*, 1904, 34, ii, 229—232).—The problem of the diffusion of an electrolyte, B.A., in presence of another, M.A., has been worked out theoretically and tested by Abegg and Bose (Abstr., 1900, ii, 127). The authors derive formulæ for the case where the dissociation is taken into account. These show that, in presence of one of its salts, an acid has a somewhat greater coefficient of diffusion than in the pure solvent.

T. H. P.

**Determination of the Relative Velocities of the Ions of Silver Nitrate in Mixtures of the Alcohols and Water and on the Conductivity of such Mixtures.** HARRY C. JONES and H. P. BASSETT (*Amer. Chem. J.*, 1904, 32, 409—445. Compare Jones and Lindsay, Abstr., 1903, ii, 55).—The experiments described were carried out with the object of ascertaining the effect of mixtures of methyl alcohol and water on the relative velocities of the ions of a salt, such as silver nitrate. The conductivity of solutions of silver nitrate in water, ethyl alcohol, methyl alcohol, and mixtures of water with each of these alcohols containing 25, 50, and 75 per cent. of the alcohol respectively was determined at 0° and 25°, and the temperature-coefficients of conductivity of the salt in the various solutions were calculated. The results are tabulated and also plotted as curves.

The molecular conductivity in water, ethyl alcohol, and mixtures of these solvents does not show a minimum point either at 25° or 0°, but the curves representing these conductivities indicate that a minimum is approached at 0°. On comparing the conductivities at 0° with those at 25°, it is evident that the influence of one solvent on the other decreases with rise in temperature. In the case of solutions in mixtures of water and methyl alcohol, a minimum point in the conductivity was found both at 25° and 0°.

Determinations were made of the relative velocities at 0° and 25° of the ions of silver nitrate in water, ethyl alcohol, methyl alcohol, and mixtures of methyl alcohol and water containing 25, 50, or 75 per cent. of the former. A comparison is made of the relative temperature-coefficient of ionic mobility for the ions of silver nitrate in water, methyl alcohol, and various mixtures of these solvents, and the temperature-coefficients of mobility of the solvents have been

calculated. The apparatus employed was a modification of that described by Mather (Abstr., 1902, ii, 300). It was found that the difference in the relative velocities in the pure solvents at  $0^\circ$  and  $25^\circ$  decreases as the temperature rises, but with the mixed solvents the opposite is generally the case. The relative velocities depend greatly on the nature of the solvent, and in mixed solvents are found to vary both with the temperature and composition of the mixture.

E. G.

**Migration of the Ions in Methyl Alcohol as Solvent.** C. DEMPWOLFF (*Chem. Centr.*, 1904, ii, 1376; from *Physikal. Zeit.*, 5, 637—641).—The transport numbers for solutions of potassium chloride, potassium bromide, potassium iodide, lithium chloride, lithium bromide, sodium iodide, sodium methoxide, and silver nitrate have been determined at  $19^\circ$  in a Hittorf's apparatus without diaphragm, using cadmium, platinum, or silver electrodes. The transport numbers of the anions increase with dilution until they reach a constant value. The most dilute solutions were about decinormal. The electric conductivities of solutions of these salts have also been determined at  $18^\circ$ . The results obtained in the case of the iodides are somewhat uncertain. The following table gives the values obtained for the transport numbers of the metallic ion in the case of each compound and the conductivity  $\Lambda_\infty$ .

Transport No. $\Lambda_\infty$ .			Transport No. $\Lambda_\infty$ .		
KCl .....	0.56	92	LiBr .....	0.45	78
KBr .....	0.58	98	NaI .....	0.45	94
KI .....	0.68	98	NaMeO .....	0.44	94
LiCl .....	0.48	77	AgNO <sub>3</sub> .....	0.56	98

The mean values of the mobility in absolute methyl alcohol were found to be for potassium 54, lithium 37, chlorine 40, and bromine 41. Cadmium and silver salts appear to undergo a process of "alcoholysis" and the values of the conductivity for silver nitrate are therefore too low (mobility of NO<sub>3</sub>, 55!). The *E.M.F.* of concentration chains of potassium chloride, potassium bromide, lithium chloride, and lithium bromide have been determined and found to agree with the value calculated from Nernst's equation.

E. W. W.

**New Class of Ions.** GEORGES MOREAU (*Compt. rend.*, 1904, 139, 916—917. Compare Abstr., 1904, ii, 536).—Air which has been passed through an aqueous salt solution and then through a tube heated at  $1000^\circ$  behaves like an ionised gas, and conducts readily when cooled to  $100^\circ$ . The difference of potential required to produce the maximum current between two electrodes placed in the stream of cooled gas has been measured and the mobility of the ions calculated from this. The positive and negative ions are found to move with the same velocity. Using a solution of definite concentration, the ionic mobility diminishes rapidly as the distance from the source of heat increases; this diminution is not due to fall of temperature, for this was maintained sensibly constant ( $100$ — $140$ ). The mobility varies



approximately inversely as the square root of the concentration in the case of the readily ionised potassium salts. The active ions appear to be analogous to those which impart conductivity to the air in the neighbourhood of oxidising phosphorus.

H. M. D.

**Use of Helium as Thermometric Substance and its Diffusion through Quartz.** ADRIEN JAQUEROD and F. LOUIS PERROT (*Compt. rend.*, 1904, 139, 789—790).—The proposed measurement of high temperatures by means of the expansion of helium in quartz vessels is impossible in consequence of the permeability of the quartz to helium. The rate of diffusion is proportional to the pressure of the gas. At 1100° it is very rapid, and even at about 220° it is perceptible.

H. M. D.

**New Form of Pyrometer.** NICOLAI S. KURNAKOFF (*Zeit. anorg. Chem.*, 1904, 42, 184—202).—Curves of cooling of antimony, cadmium, bismuth, and tin respectively were investigated by aid of a modified form of the Eschenhagen-Toepfer pyrometer.

A. McK.

**Thermal Conductivity of Crystalline Bismuth.** F. LOUIS PERROT (*Arch. Sci. Phys. Nat.*, 1904, [iv], 18, 445—457).—The ratio of the conductivity perpendicular to and parallel to the principal axis of crystalline bismuth was found by Senarmont's method to be 1.288, 1.308, 1.408, and 1.390 in the case of four different specimens, of which the first was not so perfect as the other three. The mean of the three last, 1.368, agrees fairly with the single value found by Lownds, 1.42. The author then determined the ratio of the times which elapse between the fusion of two different crystals placed on a cube of bismuth resting on a heated slab of iron when the direction of the flow of heat is (1) perpendicular, and (2) parallel to the principal axes. Crystals melting at 50°, 66°, and 79° were employed; the ratio for crystals 1 and 2 was 1.362, for 1 and 3, 1.373 and 1.370, the mean for all being 1.368.

C. CAILLER (*ibid.*, 457—467) comments on the agreement of the number thus obtained with the ratio of the thermal conductivities, an agreement which is remarkable, inasmuch as the last method does not give the conductivity, and seeks to explain the cause for this agreement in the particular case of bismuth (*Abstr.*, 1902, ii, 466).

L. M. J.

**Molecular Depression of the Freezing Point of Water produced by some very Concentrated Saline Solutions.** LOUIS C. DE COPPET (*J. Physical Chem.*, 1904, 8, 531—538).—Jones and Getman have shown that for many electrolytes a minimum value for the molecular depression is obtained (*Abstr.*, 1904, ii, 235) in concentrated solution. The author has collected data from his papers on the depression of the freezing point (*Ann. Chim. Phys.*, 1871, [iv], 23, 366; 1872, 25, 502; 26, 98), which show that such a minimum value obtains in the case of solutions of ammonium chloride, sodium chloride,

barium chloride, magnesium sulphate, zinc sulphate, and copper sulphate; no minimum is found in solutions of strontium nitrate, barium nitrate, lead nitrate, and sodium carbonate. In view of the increasing attention to hydrate theories, the author recalls that over 30 years ago he showed that cryoscopic phenomena are explicable by (1) the dissociation of hydrates formed by the solute at the expense of the solvent, (2) dissociation of the solute, probably hydrolytic. L. M. J.

**Molecular Depression Constant of *p*-Azoxyanisole.** H. MONMOUTH SMITH and W. H. MCCLELLAND (*J. Amer. Chem. Soc.*, 1904, 26, 1446—1450).—It has been shown by Gattermann and Ritschke (Abstr., 1890, 1119) that at 116° *p*-azoxyanisole forms a turbid liquid of fluid crystals, which at 134° becomes clear and transparent. Schenck (Abstr., 1898, ii, 286; 1899, ii, 637) has shown that both these transition points undergo abnormally large depressions, and from the depression of the "clear-turbid" transition point, using various solutes, he calculated the molecular depression constant and obtained values ranging from 503 to 859.

In the present investigation, determinations were made of the molecular depression constant of *p*-azoxyanisole, using the following solutes: naphthalene,  $\alpha$ -nitronaphthalene, anthracene, *o*- and *p*-acetyl-toluidines, acetamide, phenetole, and cinnamic acid. The average result of 23 determinations gave a value of 562, agreeing fairly well with the value 545 found by Auwers (Abstr., 1900, ii, 262).

Auwers found that when benzil was employed as the solute a value of 860 was obtained. A series of determinations of the molecular depression constant was therefore made using benzil, benzoin, benzophenone, and Michler's ketone respectively as the solute. The average of 12 determinations gave a depression constant of 825.

It has been suggested by Hulett (Abstr., 1899, ii, 468) and de Kock (Abstr., 1904, ii, 548) that the variations in the values found for the molecular depression constant are due to the solubility of the solutes in the fluid crystals, a small difference in the solubility coefficients of the solute in the two modifications of the solvent producing considerable alteration in the depression constant. E. G.

**Criticism of Clarke's New Law in Thermochemistry.** HARRISON E. PATTEN and W. R. MOTT (*J. Amer. Chem. Soc.*, 1904, 26, 1450—1453. Compare von Loeben, Abstr., 1903, ii, 269).—A discussion of Clarke's paper (Abstr., 1903, ii, 8) on a new thermochemical constant. Curves have been constructed which represent the deviations of this constant from a steady value and compare the heats of combustion calculated by Clarke with the values obtained experimentally by Thomsen. E. G.

**Heats of Combustion of Triphenylmethyl and some Triphenylmethane Derivatives.** JULES SCHMIDLIN (*Compt. rend.*, 1904, 139, 732—733).—The following table comprises the thermochemical data recorded in the original paper:

	Heat of combustion at		Heat of formation.
	Constant vol.	Constant pressure.	
Trinitrotriphenylmethane ...	2272.8 Cal.	2272.9 Cal.	- 32.7 Cal.
Trinitrotriphenylcarbinol ...	2218.3 „	2218.2 „	+ 22.0 „
Triaminotriphenylcarbinol...	2481.0 „	2483.5 „	- 36.3 „
Rosaniline hydrochloride ...	2468.6 „	2471.1 „	+ 10.6 „
Hexamethylrosaniline me- thochloride .....	3446.0 „	3450.2 „	+ 11.3 „
Triphenylmethyl.....	2377.7 „	2380.0 „	- 71.0 „
Triphenylmethyl peroxide...	4632.8 „	4636.0 „	- 18.0 „
Ditriphenylmethane ethyl acetate.....	5275.9 „	5281.0 „	- 9.0 „

The last three compounds examined were supplied by Gomberg (compare Abstr., 1901, i, 77, 638). M. A. W.

**Action of Low Temperatures on Colouring Matters.** JULES SCHMIDLIN (*Compt. rend.*, 1904, 139, 731—732).—Alcoholic solutions of rosaniline hydrochloride are solidified at the temperature of liquid air, and the colour of the solid is much less intensely red than that of the solution, but exhibits a beautiful greenish-yellow fluorescence; a similar change is observed with solutions of the salts of hexamethylrosaniline, whilst in the case of eosin the intensity of the red colour as seen by transmitted light is diminished when the solution is solidified in liquid air and the fluorescent colour remains unaltered: these facts are in accordance with Stokes's theory of the difference in origin of fluorescent and transmitted colours.

Solutions of malachite-green or methylene-blue do not undergo any change in colour when cooled in liquid air. M. A. W.

**Dilatometric Measurements of Tautomeric Substances.** F. GIOLITTI (*Gazzetta*, 1904, 34, ii, 208—220).—Pure ethyl acetoacetate, boiling at 181—181.5°, has the sp. gr. 1.0236 at 15°, which gives a molecular volume of 126.9; this value is not altered by the addition of piperidine or sodium ethoxide. Traube's data (Abstr., 1896, i, 593) give the number 127.9 for the enolic modification and 132.8 for the ketonic form. Dilatometric investigations show that between the temperatures - 16° and + 100° ethyl acetoacetate does not alter in constitution or else the change is a uniform one and the interval of transformation has its extreme limits outside the above range of temperature.

With acetylacetone, dilatometric measurements between 70° and 95° indicate an increase in the proportion of the ketonic form, which is in agreement with the observations of Perkin (*Trans.*, 1892, 61, 800).

Acetylacetonechloral (Gigli, Abstr., 1899, i, 12) shows, however, no contraction in solution, as would be expected from its behaviour towards ferric chloride and as was shown by Traube (*loc. cit.*) in the case of ethyl acetoacetate.

Physical and chemical methods of detecting tautomeric forms do not, therefore, agree, the results obtained being often uncertain and sometimes contradictory. T. H. P.



**Theories on Osmosis, Solubility, and Narcosis.** ISIDOR TRAUBE (*Phil. Mag.*, 1904, [vi], 8, 704—715; *Zeit. physiol. Chem.*, 1904, 105, 541—558).—OVERTON (Abstr., 1897, ii, 337), as the result of a large series of experiments, has evolved the theory that the velocity of osmosis through membranes is determined by the magnitude of the distribution-coefficient between fat and water, and assumes that solution in the fatty substance of the membrane takes place, and that then the substance is passed on from the membrane to the interior of the cell. He has also shown that all the trustworthy narcotics and anæsthetics are rapidly diffusing substances and deduces a theory according to which the efficacy of a narcotic depends principally on its lipoidic solubility. The author urges various objections to these views. Why should not the dissolved substance be more firmly held by the lipid substance of the membrane? Why does water penetrate membranes more rapidly than anything else? Salts not soluble in fats can penetrate cells. Experiments on diagraphms indicate that the content of lipid does not determine the sequence of osmotic velocity. The author then states his views, the result of long-continued researches on capillarity constants. The greater the osmotic velocity of a soluble substance, the more it reduces the capillarity constant of water, whilst substances which cannot penetrate the membrane increase the capillarity constant (no exception found). Hence the difference of the surface tensions determines the direction and velocity of osmosis and is the motive force. Applying this to solubility questions, and considering that it is the pure solvent which migrates into the salt solution, it follows that the surface tension of the solution will never fall below that of the solvent—at equality the solution is saturated. It has been found that equal equivalents of substances belonging to homologous series exercising a strong influence on capillarity lower the capillary height of water in the proportion  $1 : 3 : 3^2 : 3^3 \dots$ . Examples of this are given in the case of the acetates. If methyl alcohol reduces the surface tension of water to a less extent than ethyl alcohol, its tendency to separate from the solution will be less, and hence also its distribution coefficient between a liquid such as benzene and water. Experiments indicate that the distribution-coefficients between benzene, carbon tetrachloride or carbon disulphide, and water for methyl, ethyl, and propyl acetates are also in approximately the ratio  $1 : 3 : 9$ . Overton's experiments indicate also that this same quantitative relationship holds for the narcotic effect of homologous series (see also Abstr., 1903, ii, 63).

L. M. J.

**Breaks in the Solubility Curves.** WILHELM MEYERHOFFER (*J. Physical Chem.*, 1904, 8, 571—575).—A continuation of the discussion with Ostwald (Abstr., 1903, ii, 280). Gay-Lussac found a break in the solubility curve of Glauber's salt, but he did not establish any connection between the temperature of this and the inversion temperature. He further states in 1839 that the break in the solubility of chlorine hydrate is due to the decomposition, so that above  $8^\circ$  the solubility is that of chlorine, and proceeds: "as for sodium sulphate its decreasing solubility as the temperature rises above

33° can be referred to a decrease in the affinity." It appears clear therefore that Gay-Lussac did not know that Glauber's salt is decomposed at 33° and did not recognise the significance of the break.

L. M. J.

**Liquid Crystals.** ALFRED COEHN (*Zeit. Elektrochem.*, 1904, 10, 856—857).—If a liquid is suspended in another and an *E.M.F.* be applied to the emulsion, then the liquid with the smaller dielectric constant will move towards the anode. The author has attempted to discover, by the application of this fact, whether turbid *p*-azoxyanisole is a mixture of two substances. No movement could be detected. He points out, however, that no movement would occur in a mixture of two substances having the same dielectric constant, and that the movement would not be observed in a mixture of two substances in equilibrium provided that the disturbance of equilibrium caused by the movement was compensated sufficiently rapidly.

It was also found impossible to effect any separation of the turbid liquid by centrifugal force.

When *p*-azoxyanisole is frequently heated above the temperature at which it becomes clear and allowed to solidify, a dark coloured substance collects in the tube; this may point to the presence of an impurity.

T. E.

**The Colloidal State.** G. E. MALFITANO (*Compt. rend.*, 1904, 139, 920—922).—The author considers that matter in the colloidal state represents a system composed of a dissociated electrolyte with insoluble molecules grouped around the ions.

H. M. D.

**Composition of Colloidal Granules.** VICTOR HENRI and ANDRÉ MAYER (*Compt. rend.*, 1904, 139, 974—976. Compare Abstr., 1904, ii, 243, 325).—According to Duclaux (compare Abstr., 1904, ii, 162, 243, 325), the precipitate that is formed on mixing solutions of  $A$  equivalents of  $K_4Fe(CN)_6$  and  $a$  equivalents of  $CuSO_4$  ( $A > a$ ) always contains a certain quantity,  $\beta$ , of potassium ferrocyanide; the author has calculated from Duclaux's numbers the values of the ratio  $\beta/(A - a - \beta)$ , the partition coefficient of the  $Fe(CN)_6$  between the liquid and the precipitate for a fixed value of  $a$ , and finds that it diminishes in proportion as  $A$  increases. The composition of the colloidal precipitates examined by Duclaux may therefore be regarded as particular cases of adsorption (compare van Bemmelen, Abstr., 1900, ii, 338, 466; Biltz, Abstr., 1904, ii, 392), the granules being formed of copper ferrocyanide which has adsorbed a certain quantity of potassium ferrocyanide.

M. A. W.

**Determination of the Size of Molecules from the Kinetic Theory of Gases.** J. H. JEANS (*Phil. Mag.*, 1904, [vi], 8, 692—699).—The size of molecules may be determined from observations on (1) viscosity of gases, (2) conduction of heat by gases, (3) coefficient of diffusion of gases, (4) deviations from Boyle's law, and (5) volume occupied by matter in the solid and liquid states. In all these, the constant  $N$ , that is, number of molecules in 1 c.c. of gas



at normal temperature and pressure, also enters, and 1, 2, 3 yield values for  $NS^2$ , whilst 4, 5 give  $NS^3$ , where  $S$  is the diameter of the molecule considered as a sphere. Hence, from observations of either class,  $N$  or  $S$  may be determined. The value for  $N$  is better obtained, however, by electrical methods, and different experiments yield values of about  $4 \times 10^{10}$ . Using this as the value for  $N$ , the following values are obtained for  $S \times 10^8$ :

	Viscosity.	Conduction.	Diffusion.	Boyle's law.	Mean.
Hydrogen .....	2.05	1.99	2.03	2.05	2.03
Helium .....	1.81	—	—	—	1.81
Water vapour.....	3.39	—	—	—	3.39
Carbon monoxide ...	2.90	2.74	2.92	—	2.86
Ethylene.....	3.77	3.88	—	—	3.81
Nitrogen.....	2.90	2.74	—	3.12	2.91
Nitric oxide .....	2.82	2.81	—	—	2.82
Oxygen .....	2.81	2.58	2.71	—	2.73
Argon .....	2.79	—	—	—	2.79
Carbon dioxide .....	3.47	3.58	3.27	3.00	3.36
Nitrous oxide.....	3.54	3.48	—	—	3.52
Ethyl chloride .....	4.68	—	—	—	4.68
Chlorine .....	4.11	—	—	—	4.11

In calculating the mean, double weight is assigned to the viscosity determinations, which are probably the most accurate. L. M. J.

**Possibility of Chemical Reaction.** ROBERT DE FORCRAND (*Compt. rend.*, 1904, 139, 905—908).—If  $q$  denotes the heat development associated with the irreversible transformation of a system from the same original to the same final condition,  $q'$  the corresponding heat change in the isothermal reversible transformation, then  $q - q' > 0$  is the general condition for the possibility of the change. The author criticises the utility of this thermodynamic relationship in practice, and arrives at the conclusion that the thermochemical rule,  $q > 0$ , is the only really practical criterion of the possibility of chemical change. H. M. D.

**Prediction of Chemical Reactions.** ROBERT DE FORCRAND (*Compt. rend.*, 1904, 139, 908—911. Compare preceding abstract).—If  $q$  represents the quantity of heat developed when a system changes from the condition  $A$  to the condition  $B$ ,  $q_1$  that for the change from the condition  $A$  to the condition  $B_1$ , and if  $q'$  and  $q'_1$  are the heat changes for the corresponding isothermal reversible transformations, then the actual chemical change which takes place, assuming that the external work is sensibly equal to zero, will be from  $A$  to  $B_1$  if  $q_1 - q'_1 > q - q'$  or  $q_1 - q - (q'_1 - q') > 0$ . This relationship is termed the principle of maximum transformable heat. It is pointed out that for most chemical reactions  $q'_1 - q_1$  is small in comparison with  $q_1 - q$ , and

the principle then passes into the principle of maximum work,  $q_1 - q > 0$ . The author considers that the application of the simplified inequality is the only practical method available for the prediction of chemical change.

H. M. D.

**Free Energy of Formation.** HANS VON JÜPTNER (*Zeit. anorg. Chem.*, 1904, **42**, 235—249. Compare Abstr., 1904, ii, 549).—Theoretical.

A. McK.

**Dynamic Isomerism.** THOMAS LOWRY (*Brit. Assoc. Reports*, 1904, 1—32).—This report contains a general survey of the subject of dynamic isomerism, comprising: 1, an historical introduction; 2, a discussion of the nature of dynamic isomerism and of the influence of catalytic agents on the equilibrium; 3, a review of the principal classes of compounds exhibiting such isomerism classified according to the nature of the intermolecular changes taking place; and discussions of: 4, optical inversion; 5, the behaviour of dynamical isomerides towards reagents; 6, their physical relations, including freezing point curves, crystallography, mutarotation, refraction, magnetic rotation, electrical conductivity, colour, absorption spectra, and luminosity; and, 7, reversible polymeric change. Very full references to the literature are given.

C. H. D.

**Magnitude of the Equilibrium of the same Reaction in Different Solvents.** LEO PISSARJEWSKY (*J. Russ. Phys. Chem. Soc.*, 1904, **36**, 1070—1081).—The equilibrium constant of the reaction  $2\text{KCl} + \text{Hg}_2\text{SO}_4 \rightleftharpoons \text{Hg}_2\text{Cl}_2 + \text{K}_2\text{SO}_4$  has the same value whether the solvent is water, 20 per cent. aqueous alcohol, or 61.5 per cent. aqueous glycerol. The temperature-coefficient (between 25° and 44.2°) of the *E.M.F.* of the element,

$$\frac{\text{Hg}|0.01n - \text{KCl}, \text{Hg}_2\text{Cl}_2|n - \text{KNO}_3}{n - \text{KNO}_3} \left| \frac{\text{Hg}_2\text{SO}_4, 0.01n - \text{K}_2\text{SO}_4}{n - \text{KNO}_3} \right| \text{Hg},$$

has the same value in the first two of the above three solvents, but in 61.5 per cent. aqueous glycerol the coefficient is considerably greater. The change in the magnitude of the constant produced by adding alcohol or glycerol to the solution indicates a diminution in the degree of dissociation of the reacting compounds. This, taken together with the non-coincidence found between the constant in the above solvents and that calculated for KCl and  $\text{K}_2\text{SO}_4$  in these solvents, indicates that the degree of dissociation of these substances is less in glycerol or alcohol than in water.

T. H. P.

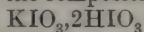
**Ozone. I. Equilibrium between Ozone and Hydrochloric Acid.** STEPHAN JAHN (*Zeit. anorg. Chem.*, 1904, **42**, 203—212).—If a current of ozonised oxygen be passed through dilute hydrochloric acid, it carries with it from the solution chlorine with a partial pressure corresponding with the concentration of hydrogen and chlorine ions in the solution, if the equilibrium in the liquid phase is established sufficiently quickly. Colloidal platinum was used as a catalyser. Ozone

alone acts very slowly on 0.05*N* hydrochloric acid, but on the addition of colloidal platinum the conductivity of the solution quickly diminishes. From this diminution of conductivity, the partial pressure of the chlorine liberated can be calculated, whilst the value for the conductivity at any given time indicates the concentration of the solution at that particular time. The amount of chloric acid formed in the solution was so small that it did not interfere with the potential measurements made.

A. McK.

**The System: Potassium Iodate, Iodic Acid, and Water at 30°.**

P. A. MEERBURG (*Chem. Centr.*, 1904, ii, 1362; from *Chem. Weekblad*, i, 474—479. Compare *Abstr.*, 1902, ii, 495; 1904, ii, 112).—The solubility of mixtures of potassium iodate and iodic acid in varying proportions has been determined at 30°. Solutions which contain 9.51 per cent. of the iodate or 76.70 of iodic acid are saturated at this temperature. Compounds of the composition  $\text{KIO}_3, \text{HIO}_3$  and



may separate from solution. The former salt can be crystallised from water at 30°, but not the latter. The compound  $\text{KIO}_3, 2\text{HIO}_3$  is only deposited from solutions containing an excess of iodic acid. The stability of these compounds is about the same at the ordinary temperature as at 30°.

E. W. W.

**Determinations in the System: Cupric Chloride, Ammonium Chloride, and Water.** P. A. MEERBURG (*Chem. Centr.*, 1904, ii, 1362—1363; from *Chem. Weekblad*, i, 551—559. Compare preceding abstract).—The conditions of equilibrium of aqueous solutions containing cupric chloride and ammonium chloride have been determined at 30°. A saturated solution of ammonium chloride at 30° contains 29.5 per cent., and a saturated solution of the dihydrate of cupric chloride,  $\text{CuCl}_2, 2\text{H}_2\text{O}$ , 48.95 per cent.; under other conditions, the only compound which separates in a solid state is the double salt,  $\text{CuCl}_2, 2\text{NH}_4\text{Cl}, 2\text{H}_2\text{O}$ . In the original paper, the experimental data are plotted out in curves; the three solubility curves cut one another in two quadruple points. A compound  $\text{CuCl}_2, \text{NH}_4\text{Cl}, \text{H}_2\text{O}$  does not exist; a mixture of the dihydrate of cupric chloride with the double salt mentioned above has probably been mistaken for a compound of this composition. The cupric ammonium chloride dihydrate is stable between  $-11^\circ$  and  $+80^\circ$ . The ice curve and the dihydrate curve intersect at the cryohydric point  $\pm -11^\circ$ .

E. W. W.

**Kinetics of the Reaction between Potassium Permanganate and Oxalic Acid.** ANTON SKRABAL (*Zeit. anorg. Chem.*, 1904, 42, 1—59. Compare *Abstr.*, 1903, ii, 684).—It is first shown that the action of potassium permanganate on an excess of oxalic acid in the presence of sulphuric acid is a unimolecular reaction, represented by  $[\text{Mn}(\text{OH})_3, \text{C}_2\text{H}_2\text{O}_4] \rightarrow \text{Mn}(\text{OH})_2 + \text{CO}_2$ . The oxidation of oxalic acid is caused by the manganic ions and accordingly the reaction just expressed takes place in two stages, thus:  $[\text{Mn}(\text{OH})_3, \text{C}_2\text{H}_2\text{O}_4] \rightarrow \text{Mn}^{+++}$  and  $\text{Mn}^{+++} + \text{C}_2\text{H}_2\text{O}_4 \rightarrow \text{Mn}(\text{OH})_2 + \text{CO}_2$ . Investigation of the action of equivalent amounts of manganese salts, in the form of phosphate and



acetate respectively, on oxalic acid did not indicate that a reaction of a higher order took place. When the concentration of the oxalic acid is increased, or when the total reaction mass is diluted so that the volume is double the original volume, the velocity coefficients in the reaction  $[\text{Mn}(\text{OH})_2, \text{C}_2\text{H}_2\text{O}_4] \rightarrow \text{Mn}^{+++}$  are not altered. The reaction  $\text{Mn}^{+++} + \text{C}_2\text{H}_2\text{O}_4 \rightarrow \text{Mn}(\text{OH})_2 + \text{CO}_2$  accordingly takes place at a rate so rapid that it cannot be measured. Only the former action, that is, the rate of the electrolytic dissociation of the manganese salt, can be measured; it is a reaction of the first order, and the velocity coefficients are constant only when the concentration of oxalic acid is constant.

The action of potassium permanganate on oxalic acid in the presence of manganous salts was studied. At first, the rate of oxidation of the oxalic acid is slow. As the reaction proceeds, manganic salt is formed accompanied by a vigorous induced oxidation of the oxalic acid and followed by the reaction of the first order just mentioned. The intermediate formation of manganic ions was recognised.

Manganese peroxide exhibits towards oxalic acid a behaviour similar to that of potassium permanganate.

The reaction between permanganate and oxalic acid takes place in the following stages, thus: (*Incubation period*) (1)  $\text{C}_2\text{H}_2\text{O}_4 + \text{KMnO}_4 \rightarrow \text{Mn}^{+++} + \text{CO}_2$  (measurable), (2)  $\text{C}_2\text{H}_2\text{O}_4 + \text{Mn}^{+++} \rightarrow \text{Mn}(\text{OH})_2 + \text{CO}_2$  (practically instantaneously); (*Induction period*) (3)  $\text{Mn}(\text{OH})_2 + \text{KMnO}_4 \rightarrow \text{Mn}^{+++}$  (less quickly than the former stage), (4)  $\text{Mn}^{+++} + \text{C}_2\text{H}_2\text{O}_4 \rightarrow \text{Mn}(\text{OH})_2 + \text{CO}_2$  (practically instantaneously), (5)  $\text{Mn}^{+++} + \text{C}_2\text{H}_2\text{O}_4 \rightarrow [\text{Mn}(\text{OH})_2, \text{C}_2\text{H}_2\text{O}_4]$  (practically instantaneously), (6)  $\text{Mn}^{+++} \rightarrow \text{Mn}(\text{OH})_2 + \text{Mn}(\text{OH})_3$  (practically instantaneously); (*End period I*) (7)  $[\text{Mn}(\text{OH})_2, \text{C}_2\text{H}_2\text{O}_4] \rightarrow \text{Mn}^{+++}$  (measurable), (8)  $\text{C}_2\text{H}_2\text{O}_4 + \text{Mn}^{+++} \rightarrow \text{Mn}(\text{OH})_2 + \text{CO}_2$  (practically instantaneously); (*End period II*) (9)  $\text{Mn}(\text{OH})_2 + \text{Mn}(\text{OH})_3 \rightarrow \text{Mn}^{+++}$  (less quickly than the former stage), (10)  $\text{C}_2\text{H}_2\text{O}_4 + \text{Mn}^{+++} \rightarrow \text{Mn}(\text{OH})_2 + \text{CO}_2$  (practically instantaneously).

The rate of stage (1) increases with increase of amount of acid present. Stage (4) is conditioned by the rate at which the ions  $\text{Mn}^{+++}$  are formed in stage (3). In presence of manganese sulphate, the incubation period is not observed, whilst the measurable reaction in the induction period proceeds very quickly. If the conditions for the formation of complex manganic salts are favourable, that is, if the concentration of oxalic acid is great and that of hydrogen ions small, stage (5) proceeds more quickly than any other stage in the induction period, and the end period is expressed by (7) and (8). Otherwise, stage (6) is the most rapid in the induction period and the end period is expressed by (9) and (10).

A. McK.

“Primary Oxide” Theory of Oxidation. ANTON SKRABAL (*Zeit. anorg. Chem.*, 1904, 42, 60—86. Compare preceding abstract). —A theoretical paper. The deductions are based on (1) Ostwald's law of successive reactions, (2) Luther's thermodynamic conclusions respecting substances with several oxidation stages, (3) the assumption that all reactions are more or less ionic, (4) the kinetic conception of chemical equilibrium, and (5) the phenomena observed during many oxidation processes. Primary oxide ions are formed during processes of

oxidation and reduction, and are characterised by their being decomposed according to the experimental conditions into two oxidation stages. All oxidation processes can be resolved into "primary reactions." "Irrespective of whether a process of oxidation is measurable, immeasurable, quick or immeasurably slow, the reduction of the primary oxide ions by acceptors and the decomposition of the primary oxide ions into two extreme stages or their conversion into complex or undissociated compounds will proceed more quickly than the primary reactions, which cause the formation of primary oxide ions." A. McK.

**Study of Reversible Oxidation and Reduction Reactions in Solutions.** EUGENE P. SCHOCH (*J. Amer. Chem. Soc.*, 1904, 26, 1422—1433).—An investigation has been carried out with the object of determining the influence of the concentrations of their components on the equilibrium in solutions of iodine, potassium ferrocyanide, potassium ferricyanide, and potassium iodide acidified with *N*/20 hydrochloric acid. The reaction is probably simple and takes place according to the equation  $2\text{Fe}(\text{CN})_6^{''''} + \text{I}_2 \rightleftharpoons 2\text{Fe}(\text{CN})_6^{'''} + 2\text{I}'$ .

Although the potassium ions and the hydrochloric acid take no part in the reaction, it is necessary to know the influence of their concentration, and for this purpose a series of *E.M.F.* measurements was made.

In order to ascertain the influence of the different members of the reaction on the chemical equilibrium, the concentrations necessary for one equilibrium were first determined; then, whilst two of the substances were kept constant, the concentration of the third was varied, and the quantity of the fourth required to restore equilibrium was determined experimentally. The results are tabulated.

It was found that the formula for equilibrium in such solutions at constant temperatures is 
$$\frac{C^4 (\text{ferrocyanide}) \times C (\text{free iodine})}{C^2 (\text{ferricyanide}) \times C^2 (\text{potassium iodide})} = K.$$

The presence in this formula of the fourth power of the concentration of the ferrocyanide instead of the second power is proved to be correct both by the *E.M.F.* measurements and the chemical equilibrium determinations. E. G.

**Oxidation Phenomena.** GEORG KASSNER (*Zeit. angew. Chem.*, 1904, 17, 1851—1856).—A lecture delivered to the pharmacological section of the Gesellschaft deutscher Naturforscher und Aerzte in Breslau, 1904. A. McK.

**Hydration and Hardening.** PAUL ROHLAND (*Zeit. Elektrochem.*, 1904, 10, 893—900).—Hydration reactions, whether organic or inorganic, take place spontaneously, and their velocity is very much affected by small quantities of foreign substances and by temperature.

Hardening does not always accompany hydration (quicklime, for example, falls to powder); it is therefore due to some special circumstance. The author believes that a solid solution is formed in all cases in which hardening accompanies hydration.

The catalytic acceleration or retardation of hydration by salts is

regarded as a result of a change of the solubility of the solid substance which is undergoing hydration. T. E.

**Limits of Sensitiveness of Odours and Emanations.** MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1904, [viii], 3, 293—295). A résumé of work already published (*Abstr.*, 1904, ii, 554).

M. A. W.

**Use of Quartz Vessels for Lecture Experiments.** EMIL FISCHER (*Ber.*, 1904, 37, 4603—4605).—Quartz vessels, the cost of which is one-tenth of that of platinum, are recommended for use in demonstrating the evolution of oxygen from nitric acid, and the formation of water. E. F. A.

**An Improved Kipp's Apparatus.** RICHARD J. FRISWELL (*Chem. News*, 1904, 90, 154—155).—The apparatus has the usual three bulbs of an ordinary Kipp's apparatus. A central tube, reaching nearly to the bottom of the lower bulb, is ground in the lower part of the top bulb and fixed with marine glue. Above the junction, the tube is widened out somewhat and rises in the top bulb to about three-fourths of the height of the latter. The bottom bulb is filled with a concentrated solution of zinc sulphate, ferrous chloride, or calcium chloride (according to the material placed in the middle bulb) to within about half an inch of the top. The acid from the top bulb passes down the central tube when the tap on the delivery tube is opened, and rises to the surface of the concentrated solution, where it comes into contact with the materials in the middle bulb. When the tap is closed, some of the heavy solution is forced up into the acid bulb, where it sinks through the lighter acid and may be drawn off, as it accumulates, by a tap which is provided for the purpose. As the economical working depends on the different densities of the fresh and exhausted acids, care must be taken to avoid mixing the strata of liquids, either by shaking when moving or by the effervescence caused by scraps of marble, &c., falling into the lower bulb. W. P. S.

**A Cheap Kipp's Apparatus.** FRANK SOUTHERDEN (*Chem. News*, 1904, 90, 286—287).—The apparatus consists of an ordinary "lime tower" down the centre of which passes a wide glass tube loosely fitting the constriction at the lower part of the tower. The top of the latter is closed by a doubly bored cork, through one hole of which is passed the neck of a large funnel, whilst the second hole carries the tap delivery tube of the apparatus. The neck of the funnel is connected by a piece of india-rubber tubing to a narrow glass tube passing down the wide tube and reaching to the bottom of the tower. The funnel serves as the acid-container and the part of the tower above the constriction is filled with ferrous sulphide, marble, &c., according to the gas which it is desired to produce. W. P. S.

**New Gas-evolution Apparatus.** S. BOŠNJAKOVIĆ (*Zeit. anal. Chem.*, 1904, 43, 624—625).—A very simple apparatus, consisting of two glass bulbs connected by channels. The whole is made of one



piece of glass. The solid reagent is placed in one of the bulbs, and when the apparatus is in one position the liquid reagent is in the other, but by tilting the vessel through  $90^\circ$ , the liquid comes in contact with the solid and evolution of gas commences. The evolution is arrested by reverting to the first position. M. J. S.

**New Hydrogen Sulphide, Carbon Dioxide, or Hydrogen Generating Apparatus.** H. ARZBERGER (*Chem. Centr.*, 1904, ii, 1358—1359; from *Pharm. Post*, 37, 581).—An apparatus for the generation of hydrogen sulphide, carbon dioxide, or hydrogen is described in which the solid iron sulphide, calcium carbonate, or zinc is contained in a Soxhlet tube fitted with an india-rubber bung through which three holes are bored. The acid, which, in the case of hydrogen sulphide, consists of a 20—25 per cent. solution of sulphuric acid or preferably hydrochloric acid, is added drop by drop from a tap funnel, the stem of which passes through one hole of the bung. The exhausted acid runs off automatically through the siphon into a flask which is fitted to the Soxhlet tube, and from this vessel it may be removed by a tap. The solid may be washed with water after use by means of a second funnel to which a tap and tube are attached, the latter passing through the second hole in the bung. The gas escapes by a tube which is inserted in the third hole of the bung, and is connected with a suitable washing apparatus. E. W. W.

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## Inorganic Chemistry.

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**Reduction of Perchlorate by the Wet Method.** B. SJOLLEMA (*Zeit. anorg. Chem.*, 1904, 42, 127—128).—Potassium perchlorate, when boiled in aqueous solution with ferrous hydroxide in the absence of free alkali, is reduced quantitatively to chloride. A. McK.

**Rate of Crystallisation of Plastic Sulphur.** JOSEPH H. KASTLE and WALTER PEARSON KELLEY (*Amer. Chem. J.*, 1904, 32, 483—503).—The rate of change of plastic sulphur into the crystalline variety has been studied by sp. gr. and dilatometric methods.

A specimen of sulphur was heated to  $200^\circ$  and poured into cold water; one portion was left in water at the ordinary temperature, whilst another was kept in water at  $70^\circ$ ; the sp. gr. of each was determined at intervals of an hour. In another experiment, the sulphur was heated to  $444^\circ$  before being poured into water; portions of this specimen were kept at  $80^\circ$ ,  $60^\circ$ , and  $40^\circ$  respectively, whilst another portion was left in cold water; the sp. gr. was determined at intervals in each case. The results indicate that the rate of change of plastic into crystalline sulphur varies according to the temperature to which the sulphur is heated before being poured into water, and also with

the temperature at which the product is preserved. The higher the initial temperature to which the sulphur is heated, the slower is the crystallisation; and the higher the temperature at which the sulphur is kept, the more rapid is the change.

In another series of experiments, a specimen of plastic sulphur was divided into five portions which were kept under water, dilute ammonia, 95 per cent. alcohol, dilute bromine water, and *N*/10 iodine solution respectively, the sp. gr. being determined at intervals in each case. It was found that ammonia, alcohol, and bromine accelerate, whilst iodine retards, the crystallisation.

A study of the effect of heat has shown that plastic sulphur has no definite melting point, the effect of any increase of temperature being merely to diminish its viscosity and to increase its tendency to pass into the crystalline form.

The stability of any particular specimen of plastic sulphur can be judged from its colour; light amber-coloured specimens crystallise easily, whilst reddish-brown varieties remain plastic for longer periods. Experiments have shown that when the plastic and orthorhombic forms of sulphur are heated at 120—125° for a sufficient length of time they become alike in colour, a state of chemical equilibrium being ultimately reached in each case.

Experiments made with the object of determining the effect of tension on the crystallisation showed that specimens of sulphur under tension crystallise more rapidly than those not under tension.

Determinations of the rate of change by the dilatometric method showed that plastic sulphur prepared by pouring into water sulphur that has been heated only to a moderately high temperature crystallises rapidly, whereas that which has been heated to near the boiling point before being poured into water crystallises very slowly. The velocity of the change of plastic into crystalline sulphur begins comparatively rapidly, about 10 per cent. of the total change taking place in the first 30 minutes, and then gradually diminishes. This gradual decrease in the rate of crystallisation indicates that several molecular forms are present in the supercooled liquid, some of which change to the crystalline variety of the element more rapidly than others. E. G.

**The Chlorides of Sulphur. Sulphur Tetrachloride and its Compounds.** OTTO RUFF (*Ber.*, 1904, **37**, 4513—4521. Compare Ruff and Fischer, *Abstr.*, 1903, ii, 204).—The author has re-examined the double compounds of sulphur tetrachloride described in the literature, and has corrected some erroneous analyses. The so-called sulphur dichloride was employed in the preparations, and the author's view is confirmed that this substance is a solution of largely dissociated sulphur tetrachloride in sulphur chloride.

Sulphur tetrachloride, prepared by the slow combination of sulphur chloride with liquid chlorine in a sealed tube, is a yellowish-white substance, melting at  $-30.5^{\circ}$  to  $-31^{\circ}$  to a red liquid. Its dissociation pressure reaches 1 atmosphere at a few degrees above its melting point. Water decomposes it in a sealed tube almost quantitatively, forming sulphurous acid.

The double compounds of sulphur tetrachloride are designated by their formulæ.

[With GEORG FISCHER.]—The compound  $\text{SCl}_4\text{SbCl}_5$ , prepared by adding sulphur chloride to a cold solution of antimony pentachloride in sulphuryl chloride and draining by means of the apparatus described by Ruff and Plato (*Ber.*, 1901, 34, 1749), forms slender, white needles melting at  $125\text{--}126^\circ$  in an atmosphere of chlorine in a sealed tube to a yellow liquid, and subliming at  $150^\circ$ . Water decomposes it vigorously. No solid compound could be obtained from sulphur tetrachloride and phosphorus pentachloride.

The salt,  $\text{SCl}_4\text{TiCl}_4$  crystallises in slender, yellow needles, often radially grouped, melts at  $62\text{--}64^\circ$  in an atmosphere of chlorine, sublimes at about  $100^\circ$ , and dissolves in sulphuryl chloride, chloroform, carbon disulphide, or light petroleum.

$2\text{SCl}_4\text{SnCl}_4$  forms large, yellow crystals, melts at  $37^\circ$ , and decomposes at about  $40^\circ$ . It fumes in air, but is more stable than the titanium compound, and dissolves readily in chloroform, light petroleum, sulphuryl chloride, carbon disulphide, phosphorus oxychloride, ether, or benzene. The corresponding compound with zirconium tetrachloride is very unstable, and could not be isolated in a pure form. A silicon compound could not be obtained.

[With EINBECK.]— $\text{SCl}_4\text{FeCl}_3$ , prepared in phosphorus oxychloride solution, forms a yellow, crystalline precipitate, decomposing rapidly on warming. The compound  $2\text{FeCl}_3\text{POCl}_3$  was obtained on warming the constituents together on the water-bath in the form of a bright yellow, crystalline mass.

[With GEORG FISCHER.]— $\text{SCl}_4\text{2ICl}_3$  forms yellow crystals, decomposing without fusion on even slight warming. No compounds could be obtained from arsenic trichloride, antimony trichloride, or chromic chloride.

[With KURT THIEL.]— $\text{SCl}_4\text{2AsF}_3$  forms yellow crystals and only attacks glass slowly, but decomposes or chars thionyl chloride, carbon tetrachloride, carbon disulphide, alcohol, ether, benzene, or light petroleum.

No compounds were obtained from antimony, tin, or titanium fluorides, or from the chlorides of uni- or bi-valent metals.

C. H. D.

Theory of the Lead Chamber Process. II. FRITZ RASCHIG (*Zeit. angew. Chem.*, 1904, 17, 1777—1785).—Polemical. A reply to Lunge (*ibid.*, 1659).  
A. McK.

Catalytic Phenomena in the Preparation of Persulphuric Acid. G. I. PETRENKO (*J. Russ. Phys. Chem. Soc.*, 1904, 36, 1081—1088).—The yield of persulphuric acid obtained by the electrolysis of sulphuric acid is dependent on the use of a platinum anode which apparently oxidises and then exerts a catalytic action, diminishing the yield of the peracid. The yield of the latter is almost doubled by the addition of hydrochloric acid. With an iridium anode, the yield is considerably less than with platinum, and the iridium goes into solution more readily than platinum.  
T. H. P.



**Ultramicroscopical Observations. I. Separation of Sulphur from Thiosulphuric Acid and of Selenium from Selenious Acid.** WILHELM BILTZ and WILLY GAHL (*Chem. Centr.*, 1904, ii, 1367; from *Nachr. K. Ges. Wiss. Göttingen*, 1904, 300—310).—By means of Raehlmann's ultramicroscope, homogeneous or "optically empty" solutions may be more readily distinguished from turbid solutions, and the phenomena of precipitation more closely followed. By means of the arrangement used, a field of 0.00004 cm. was illuminated. Filtration, or contact with cover glasses or india-rubber, destroys the optical homogeneity of solutions. Distilled water must be rendered clear before distilling, and must be protected from access of air during distillation and afterwards. A Pukall cell may be used for filtration, the air which enters the filter being made to pass through cotton-wool.

Thiosulphuric acid decomposes as soon as it is formed, the non-dissociated acid being the less stable. By means of the ultramicroscope, it has been shown that the process of decomposition is not "continuous," the discontinuity becoming apparent at about the same time as the opalescence is visible to the naked eye. Colourless, supersaturated solutions of the acid in water can, therefore, exist. Colloidal aqueous solutions of the acid appear to be blue, and are extremely unstable. The action of sulphurous acid on selenious acid has also been found to be optically discontinuous. E. W. W.

**Colloidal Tellurium. IV.** ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1904, 42, 177—183. Compare Abstr., 1902, ii, 653; 1904, ii, 613).—A detailed account of results already published. A. McK.

**Action of Hydrogen Peroxide on Tellurium.** ALEXANDER GUTBIER and F. RESENSCHECK (*Zeit. anorg. Chem.*, 1904, 42, 174—176. Compare Gutbier and Wagenknecht, Abstr., 1904, ii, 613).—When hydrogen peroxide is added to a solution of tellurium in concentrated aqueous potassium hydroxide, telluric acid is produced in small yield. A. McK.

**Apparatus for Separating Nitrogen Quickly and Completely from a Mixture of Gases containing it.** FERDINAND HENRICH (*Zeit. angew. Chem.*, 1904, 17, 1755—1757).—An apparatus is described by means of which nitrogen is separated automatically from a mixture of gases containing it, the mixed gases being repeatedly passed over heated copper and copper oxide, soda lime, phosphoric oxide, and a heated mixture of magnesium and quicklime. A full description is appended to the sketch of the apparatus in question. A. McK.

**Formation of Nitric Oxide at High Temperatures.** WALTHER NERNST (*Chem. Centr.*, 1904, ii, 1368; from *Nachr. k. Ges. Wiss. Göttingen*, 1904, 261—276. Compare Muthmann and Hofer, Abstr., 1903, ii, 206).—If a system which is in equilibrium at a high temperature is rapidly cooled, the composition of the mixture at the lower

temperature will not accurately represent the condition at the higher, since the cooling cannot be effected instantaneously. In all cases, no matter in which direction the composition of the gaseous mixture deviates from that of the equilibrium state, the proportion of the product formed at the higher temperature will be too small, except for a small temperature interval in which the curve calculated from thermodynamical data touches that obtained from observed values. In cases in which it is impossible to allow sufficient time for the state of equilibrium to be attained because the temperature is too low and the velocity of the action too small, the velocities of the opposing reactions may be measured by experiments on streams of gas at different velocities. The concentration at which both reactions have the same velocity, and hence the equilibrium constant, may be calculated. When gases are brought to very high temperatures for a very short time, as, for instance, when a mixture of hydrogen and oxygen in the proportions contained in water is exploded with air and the mixture rapidly cooled, an examination of the products of the explosion may serve, under certain conditions, to ascertain the conditions of equilibrium at such temperatures.

A litre of air was passed through platinum or iridium tubes and the nitric oxide absorbed in sulphuric acid. The temperature was estimated by means of a thermo-element or a photometer. At temperatures above  $1700^{\circ}$ , equilibrium was attained when one litre passed through the tube in 20 minutes. At  $1760^{\circ}$ , the equilibrium concentration of the nitric oxide was found to be 0.64 per cent. by volume and at  $1922^{\circ}$  0.97 per cent. The "heat-toning" of the reaction calculated from these data is 45,600 cals., whilst the value found by experiment was 43,200. A state of equilibrium could not be obtained in the platinum furnaces at  $1538^{\circ}$ . The velocities of the opposing reactions show that the reaction is bimolecular and that the equilibrium concentration of the nitric oxide is 0.37 per cent. by volume. From Bunsen's determinations of the decrease of volume caused by exploding mixtures of hydrogen and oxygen with air, it has been calculated that at  $3500^{\circ}$  the mixture contains about 5 per cent. by volume of nitric oxide when equilibrium is established. Under the ordinary atmospheric pressure, the time required to convert half the nitrogen of air into nitric oxide is about 100 seconds at  $1540^{\circ}$  and 3.5 at  $1737^{\circ}$ . The following table shows the observed and calculated equilibrium constants  $\chi$  at temperatures from  $1500$ — $3200^{\circ}$ :

Temp. (abs.).	$\chi$ observed.	$\chi$ calculated.
1811°	0.37	0.35
2033°	0.64	0.67
2195°	0.97	0.98
3200°	about 5	4.4

E. W. W.

**Preparation of Yellow Arsenic.** ALFRED STOCK and WERNER SIEBERT (*Ber.*, 1904, 37, 4572—4575).—A special form of apparatus is described and figured by means of which arsenic is sublimed in a vacuum and the vapour immediately cooled by liquid air. Under

these conditions, a yellow modification of arsenic is deposited, which, when exposed to light, is instantly converted into the black modification. A similar change takes place in the dark, when the yellow form is allowed to assume the ordinary temperature, but the change is not accompanied by any luminescence phenomena. E. F. A.

**The Preparation of Pure Boron Trifluoride and Silicon Tetrafluoride and some Physical Constants of these Compounds.**

HENRI MOISSAN (*Compt. rend.*, 1904, 139, 711—714).—Boron trifluoride, prepared by heating a mixture of boron trioxide, calcium fluoride, and sulphuric acid, and purified by passing through cylinders containing sodium fluoride and finally by solidifying in a vacuum (compare Abstr., 1903, ii, 642), melts at  $-127^{\circ}$  and boils at  $-101^{\circ}$  (compare Abstr., 1904, ii, 331); the corresponding constants of the synthetical compound are  $-126^{\circ}$  and  $-99^{\circ}$  respectively.

Silicon tetrafluoride, similarly prepared and purified, and also the synthetic compound, solidifies at  $-97^{\circ}$  under atmospheric pressure, and volatilises without passing through the liquid stage (compare Olszewski, Abstr., 1884, 816) under a pressure of 2 atmospheres. Silicon tetrafluoride melts at  $-77^{\circ}$  to a transparent, mobile liquid, which boils at  $-65^{\circ}$  under 181 cm. pressure; the critical temperature is  $-1.5^{\circ}$ , and the critical pressure 50 atmospheres. M. A. W.

**Action of Boric Acid on the Alkali Peroxides. Formation of Perborates.**

GEORGE F. JAUBERT (*Compt. rend.*, 1904, 139, 796—798).—When an intimate mixture of 248 grams of boric acid and 78 grams of sodium peroxide is gradually added to 2 litres of cold water, a clear solution is first obtained from which the perborate,  $\text{Na}_2\text{B}_4\text{O}_9 \cdot 10\text{H}_2\text{O}$ , crystallises after a time in 90 per cent. yield. The aqueous solution of the perborate contains free hydrogen peroxide. Its solubility at  $11^{\circ}$ ,  $22^{\circ}$ , and  $32^{\circ}$  was found to be 42, 71, and 138 grams per litre. The perborate cannot be recrystallised from its aqueous solution.

When a quantity of hydrochloric acid equivalent to half the sodium in the perborate is added to this solution, a perborate,  $\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$ , separates in the form of white crystals which are very stable at the ordinary temperature and are not affected by atmospheric carbon dioxide. This salt is less soluble than the first perborate; its aqueous solution slowly decomposes at  $50-60^{\circ}$  and evolves oxygen rapidly at  $100^{\circ}$ . The solution has all the properties of hydrogen peroxide, and on account of its stability in the air the crystalline salt may conveniently be used as a means of obtaining an aqueous solution of hydrogen peroxide. H. M. D.

**Tension of Carbon Dioxide in Sea Water and the Reciprocal Influence of the Carbon Dioxide of the Sea and of the Atmosphere.**

AUGUST KROGH (*Compt. rend.*, 1904, 139, 896—898).—The ocean contains about  $6.55 \times 10^{10}$  kilograms of carbon dioxide in the form of readily dissociated salts or twenty-seven times the quantity contained



in the atmosphere, and the variation of this quantity with the pressure is expressed in the following table :

Pressure per cent.	Quantity in kilos.
0.01	$4.57 \times 10^{16}$
0.02	$5.89 \times 10^{16}$
0.03	$6.55 \times 10^{16}$
0.04	$7.04 \times 10^{16}$
0.05	$7.36 \times 10^{16}$

A series of determinations of the tension of carbon dioxide in the sea and in the atmosphere has given the following results : (1) in the north of the Atlantic Ocean, the tension of carbon dioxide is much lower in the water than in the atmosphere ; (2) the atmosphere over the Atlantic Ocean and its shores contains less carbon dioxide (0.029 per cent.) than in Central Europe (0.033 per cent.) ; (3) in the southern hemisphere, where the ocean covers the major part, the atmosphere contains less carbon dioxide than in the northern hemisphere (0.026 per cent.). It follows, therefore, that the percentage of carbon dioxide in the atmosphere is increasing, and that the sea compensates for the increase by absorbing the gas.

M. A. W.

#### Action of Potassium Cyanide Solution on Various Metals.

ANDRÉ BROCHET and JOSEPH PETIT (*Bull. Soc. chim.*, 1904, [iii], 31, 1255—1257. Compare Abstr., 1904, ii, 229, 230, and 414).—Aluminium and magnesium are readily attacked in the cold by potassium cyanide solution, copper and zinc less readily, yielding respectively the salts  $\text{Cu}_2(\text{CN})_2, 6\text{KCN}$  and  $\text{Zn}(\text{CN})_2, 2\text{KCN}$  and other metals very slowly except on heating. Cadmium and silver are attacked by potassium cyanide solution in presence of oxygen, but mercury is unaffected, and the amalgamation of a metal retards the action of the salt on it.

Deville and Debray (*Compt. rend.*, 1876, 82, 241) and Glaser (Abstr., 1903, ii, 242) have shown that platinum dissolves in solutions of potassium cyanide. The author finds that this does not occur unless the solution of the cyanide is heated, and that the effect is diminished by polishing the platinum.

T. A. H.

#### Action of Potassium Cyanide on Metallic Electrodes.

ANDRÉ BROCHET and JOSEPH PETIT (*Bull. Soc. chim.*, 1904, [iii], 31, 1257—1261. Compare Abstr., 1904, ii, 229, 230, and 414).—Most metals behave as soluble anodes when placed in potassium cyanide solution under the influence of an alternating current. A number of metals, including copper, zinc, silver, and cadmium, dissolve quantitatively when the current is weak. Nickel dissolves quantitatively so long as the current does not exceed 2 amperes per sq. decimetre ; beyond this, the dissolution diminishes, reaching a minimum of 80 per cent. of the theoretical when the current density is 8 amperes per sq. decimetre (compare Le Blanc and Schick, Abstr., 1904, ii, 230). Cobalt dissolves irregularly, and the anode becomes pitted. Mercury is almost immediately covered by a black precipitate which prevents

further action, but amalgamation has no effect on the dissolution of copper and zinc. Lead is almost without action.

Silver begins to deposit on the cathode almost as soon as it appears in the electrolyte, and cadmium behaves similarly, but copper, zinc, and nickel deposit only with difficulty, whilst with cobalt and iron no deposition occurs.

The observation of Glaser (Abstr., 1903, ii, 242) that platinum is dissolved when employed as a cathode in potassium cyanide solution is confirmed, and it is shown that the action is much more marked when barium cyanide is employed as the electrolyte. This dissolution of platinum under these conditions is due to the disintegration of the cathode, probably with the transitory formation of an alloy with the alkali metal and the dissolution in the electrolyte of the finely-divided platinum particles so liberated (compare Bredig and Haber, Abstr., 1899, ii, 78; Haber and Sack, Abstr., 1902, ii, 441; Bran, *ibid.*, ii, 442). In favour of this view is the slow evolution of hydrogen which takes place from the cathode immediately after the current has been stopped.

T. A. H.

### Theory of the Dissolution of Metals in Potassium Cyanide Solution under the Influence of an Alternating Current.

ANDRÉ BROCHET and JOSEPH PETIT (*Bull. Soc. chim.*, 1904, [iii], 31, 1261—1265. Compare preceding abstracts).—Such metals as silver, which are quantitatively dissolved from the anode and deposited on the cathode, are insoluble in potassium cyanide solution under the action of an alternating current. On the contrary, copper, zinc, nickel, and cobalt, which are either not deposited or deposited only with difficulty, are soluble in potassium cyanide solution. The cases of iron and platinum, which behave as insoluble anodes and slightly soluble cathodes, and yet are readily dissolved by potassium cyanide solution under the action of an alternating current, are not so easily explicable. Platinum also dissolves in the cyanide solution under the action of a continuous current frequently interrupted, and it is probable that its dissolution is due to disintegration while it momentarily acts as a cathode, the dissolution of the detached particles being facilitated by the oxidising action of the platinum electrode immediately afterwards functioning as an anode.

The original paper contains a series of curves showing (a) the influence of current frequency (from 5 to 100 per second) on the rate of dissolution of various metals, and (b) the simultaneous influence of current density and frequency on the rate of dissolution of nickel. The first set of curves shows that as the frequency is increased, copper dissolves less quickly, whilst iron, nickel, and cobalt exhibit a maximum and then diminish; with platinum, the maximum is unattainable under these conditions. The second series of curves appears to show that nickel behaves like copper when the current density is less than 7 amperes per sq. decimetre, but above this behaves like iron, and that when frequency and density are simultaneously and sufficiently increased no solution should occur. The latter deduction is not in harmony with the experimental observation recorded in the preceding abstract.

T. A. H.

**Reactions between Salts in Non-aqueous Solutions. II. In Acetone.** ALEXANDER NAUMANN [and, in part, with WILHELM EIDMANN, MAX MÜLLER, PAUL SCHÜLZ, and ERNST VOIGT] (*Ber.*, 1904, 37, 4328—4341. Compare *Abstr.*, 1904, ii, 819).—Pure anhydrous acetone of sp. gr. 0.795 at  $18^{\circ}/4^{\circ}$  was used. The following salts are readily soluble: aluminium bromide, ammonium bromide, trichromate, iodide, nitrate, perchlorate, and thiocyanate; antimony tribromide, chloride (0.186), and iodide; barium bromide and iodide; bromine; cadmium bromide (64.5), chlorate, iodide (4), and nitrate; caesium nitrate; calcium bromide, chlorate, dichromate, iodide, and nitrate; cerium bromide, chloride, iodide, and nitrate; chromic nitrate; chromic anhydride; ferric chloride (1.59) and nitrate; ferrous chloride; erbium nitrate; iodine; potassium bromide, chlorochromate, ferricyanide, ferrocyanide, iodide, permanganate, mercuriodide, and thiocyanate; cobalt chloride (36.4), bromide, iodide, and nitrate; cupric bromide, chloride (34.7), and chlorate; lanthanum nitrate; lithium bromide, chloride, iodide, and nitrate; magnesium bromide, chlorate, chloride, and iodide; palladous chloride; platinic chloride; mercuric chloride (0.7), bromide, and nitrate; rubidium nitrate; sulphur; silver nitrate (227) and nitrite; thallic nitrate; uranium bromide; uranyl chloride, iodide, and nitrate; bismuth trichloride (5.59) and tri-iodide; zinc chloride (2.3) and iodide; stannous chloride (1.8); stannic chloride, bromide, and iodide. The numbers in brackets indicate the number of grams of acetone required to form a saturated solution with 1 gram of the salt at  $18^{\circ}$ .

The following salts are very sparingly soluble: aluminium chloride and nitrate; ammonium chromate, diborate, and thiosulphate; barium chlorate and nitrate; lead bromide and nitrate; cadmium chloride; calcium chloride; potassium nitrate; lithium diborate; sodium dichromate; mercuric iodide; rubidium bromide; strontium chloride and nitrate; thallic chloride; thorium nitrate.

A list of some 197 insoluble compounds is given.

Ammonia yields precipitates with acetone solutions of the following salts: cupric, bismuth, antimony, cobaltous, mercuric, stannous, and zinc chlorides, silver nitrate, cadmium bromide, and cadmium iodide. The precipitates in all cases are additive compounds of the salt and ammonia.

The following yield precipitates of silver haloids with silver nitrate in acetone solution: bismuth, antimony, ferric, cobaltous, mercuric, strontium, and zinc chlorides, cadmium bromide and iodide. Hydrogen sulphide precipitates the metals of stannous chloride, bismuth chloride, silver nitrate, and cadmium bromide as sulphides. It precipitates mercuric chloride as  $\text{HgCl}_2 \cdot 2\text{HgS}$ , and cadmium iodide as  $\text{CdI}_2 \cdot 2\text{CdS}$ . Double decomposition has been observed between cadmium bromide and mercuric chloride, cupric chloride and calcium bromide, bismuth chloride and potassium iodide, mercuric chloride and cadmium iodide, mercuric chloride and bismuth iodide, and also between potassium thiocyanate and solutions of the following salts: zinc chloride, silver nitrate, and cobalt chloride.

Cupric, ferric, and mercuric chlorides are reduced by stannous chloride. Ferric and cupric chlorides are reduced by potassium iodide, and ferric chloride partially by hydrogen sulphide.



Acetone solutions of silver nitrate yield precipitates with hydrogen chloride, bromide, or iodide, and, in the case of the bromide and iodide, the precipitate dissolves in an excess of the acid. Silver nitrate and sulphur yield  $\text{Ag}_2\text{S}_2$ .

Mercuric chloride and cuprous bromide yield mercurous bromide, cuprous chloride, and chlorine; cadmium bromide is decomposed by an acetone solution of chlorine, and cuprous chloride, which is insoluble in acetone, yields, with an acetone solution of chlorine, cupric chloride, with bromine, a mixture of cupric chloride and bromide, and with an iodine solution, cuprous iodide and cupric chloride. Mercurous chloride, suspended in acetone, is only slightly affected by chlorine, but with bromine and iodine yields mixtures of mercuric chloride with the bromide and iodide.

J. J. S.

**Reactions between Salts in Non-aqueous Solutions. III.**  
ALEXANDER NAUMANN [and JOHANNES SCHROEDER] (*Ber.*, 1904, 37, 4609—4614. Compare Abstr., 1904, ii, 819).—The solubility of a large number of inorganic salts in pyridine was determined qualitatively. The compound  $\text{HgCl}_2 \cdot \text{C}_5\text{H}_5\text{N}$ , prepared by the addition of mercuric chloride to pyridine, crystallises in needles. Its behaviour, when dissolved in pyridine, towards ammonia, hydrogen sulphide, and stannous chloride is similar to that of mercuric chloride. With ammonium thiocyanate and silver sulphate it gives precipitates of ammonium chloride and mercuric sulphate respectively.

The compound  $\text{CuCl}_2 \cdot 2\text{C}_5\text{H}_5\text{N}$ , prepared by the addition of cupric chloride to pyridine, separates from alcohol in needles. Its behaviour and that of the compound  $\text{AgNO}_3 \cdot 2\text{C}_5\text{H}_5\text{N}$  (in pyridine solution) and of a solution of silver sulphate in pyridine towards various reagents is described in considerable detail.

A. McK.

**Sodamide and certain of its Reaction Products.**  
W. PHILLIPS WINTER (*J. Amer. Chem. Soc.*, 1904, 26, 1484—1512).—A convenient method is described for the preparation of sodamide.

When sodamide is exposed to dry air, it slowly assumes a yellowish-brown colour and is found to contain nitrous and hyponitrous acids.

When sodamide is decomposed by water, hydrogen and nitrogen are produced. The relative proportions of these gases vary with the condition of the sodamide. It has been found that the proportion of hydrogen is high in the case of sodamide which has been insufficiently heated owing to the presence of unchanged sodium; but is low when the sodamide has been properly prepared. Nitrogen is always evolved to a small extent and is formed in larger proportion from sodamide which has been kept for some time than from freshly prepared specimens. The production of the nitrogen is probably due to the presence in the sodamide of sodium azoimide or some analogous compound formed by oxidation of ammonia either in the process of manufacture of the sodamide or during its exposure to dry air.

If finely powdered sodamide is sprinkled into a vessel containing water heated nearly to boiling through which a current of carbon

dioxide is being passed, a shower of brilliant sparks is produced and a solution of disodium cyanamide is formed.

When sodamide is treated with phosphorus pentachloride, a violent reaction takes place and a white sublimate is produced which consists of ammonium chloride, sodium chloride, traces of phosphorus compounds, and a small quantity of a *substance* insoluble in water. This insoluble compound cannot be isolated, but when the soluble substances are removed from the sublimate by means of nitric or acetic acid, a white, nearly tasteless, odourless *compound*,  $\text{PO}_2\text{N}$  or  $\text{PH}_2\text{O}_2\text{N}$ , is obtained, which is not affected by hot strong mineral acids.

When sodamide is warmed with yellow phosphorus, an energetic reaction occurs, and the product consists of sodium phosphide and other substances, including oxy-acids of phosphorus and probably an amide of phosphorus. E. G.

### Supercooled Fusions and Solutions of Sodium Thiosulphate.

STEWART W. YOUNG and J. P. MITCHELL (*J. Amer. Chem. Soc.*, 1904, 26, 1389—1413).—Sodium thiosulphate pentahydrate exists in three forms: the ordinary commercial or  $\alpha$ -form, the  $\beta$ -form described by Parmentier and Amat (*Abstr.*, 1884, 819), and the  $\gamma$ -form discovered in the course of the present investigation. The  $\beta$ -form is obtained most readily by heating the  $\alpha$ -form at  $80$ — $100^\circ$  for a few minutes in a sealed glass tube and cooling to  $-10^\circ$  or  $-20^\circ$ , when the product solidifies in long needles. The  $\gamma$ -form is produced occasionally instead of the  $\beta$ -form; the conditions necessary for its formation have not been fully investigated, but it appears that the presence of a small excess of water in the tube favours its production. This  $\gamma$ -modification is obtained as a compact, opaque mass which melts at a little above  $0^\circ$ , whilst the  $\beta$  and  $\alpha$ -forms melt at about  $32^\circ$  and  $49^\circ$  respectively. Each of these forms on melting is converted into a saturated solution and a lower hydrate.

Four different lower hydrates are described. The  $\alpha$ -form is obtained when the  $\alpha$ -pentahydrate is melted and left at the ordinary temperature for a day or two. The  $b$ -form is produced by the partial fusion of the  $\alpha$ -form, the  $d$ -form by the partial fusion of the  $\beta$ -pentahydrate, and the  $c$ -form by the partial fusion of the  $\gamma$ -pentahydrate.

A large number of experiments have been made with the object of ascertaining the conditions under which these various forms are produced from supercooled solutions and fusions, attention being paid particularly to the form of the thiosulphate from which the solution or fusion was prepared, the rate at which the tubes were cooled, the temperature to which they were heated, and the length of time for which the heating was continued. For the details of these experiments and the results obtained, the original must be consulted.

In order to afford an explanation of the results of this investigation, a hypothesis is put forward based on that proposed by Jaffé (*Abstr.*, 1903, ii, 469), which ascribes the initiation of the crystallisation to the presence of nuclei. It is suggested that these nuclei consist of fragments of crystalline aggregates left in the liquid after the breaking down of the crystalline structure and that, under certain conditions,

they unite to form crystalline aggregates which are capable of starting the crystallisation. E. G.

**Composition and Solubility of the Hydrates of Sodium Thiosulphate.** STEWART W. YOUNG and W. E. BURKE (*J. Amer. Chem. Soc.*, 1904, **26**, 1413—1422. Compare preceding abstract).—Considerable difficulty was experienced in determining the composition of the various hydrates of sodium thiosulphate owing to the fact that all the other forms are metastable with respect to the  $\alpha$ -form and are rapidly converted into this form if a trace of it is present. Parmentier and Amat (Abstr., 1884, 819) have shown that the  $\beta$ -form consists of a pentahydrate. There is little doubt that the  $\gamma$ -form is also a pentahydrate, although hitherto it has not been analysed. Analyses have been made of the  $a$ -,  $b$ -, and  $d$ -forms, which show that the first two consist respectively of a monohydrate and a dihydrate and that the  $d$ -form is probably a tetrahydrate. The composition of the  $c$ -variety has not been ascertained.

Determinations of the solubility of these different hydrates have given the following results, which are expressed as the number of parts of the anhydrous salt,  $\text{Na}_2\text{S}_2\text{O}_3$ , in 100 parts of water. The solubility of the  $\alpha$ -form of sodium thiosulphate is 59.69 at  $10^\circ$ , 70.07 at  $20^\circ$ , 75.90 at  $25^\circ$ , 82.45 at  $30^\circ$ , 91.24 at  $35^\circ$ , 103.37 at  $40^\circ$ , and 123.87 at  $45^\circ$ . In the case of the  $\beta$ -form, the values obtained were 97.55 at  $20^\circ$ , 108.98 at  $25^\circ$ , 119.69 at  $28^\circ$ , 126.50 at  $29.5^\circ$ , and 130.26 at  $30^\circ$ . The solubility of the  $\alpha$ -form is 163.92 at  $20^\circ$ , 168.32 at  $25^\circ$ , and 174.20 at  $30^\circ$ . For the  $b$ -form, the values found were 122.68 at  $20^\circ$ , 127.43 at  $25^\circ$ , 133.27 at  $30^\circ$ , 138.84 at  $35^\circ$ , 144.92 at  $40^\circ$ , and 165.11 at  $50^\circ$ . In the case of the  $d$ -form, the solubility was found to be 141.48 at  $33.5^\circ$ , 153.23 at  $36.2^\circ$ , and 168.82 at  $38.6^\circ$ . The solubilities of the  $\gamma$ - and  $c$ -forms have not been determined. These solubility data have been plotted as curves which are of particular value as defining exactly the ranges of supercooling and supersaturation of the forms studied.

E. G.

**Formation and Constitution of Bleaching Powder.** NAZARENO TARUGI (*Gazzetta*, 1904, **34**, ii, 254—260).—The author finds that the formation of bleaching powder containing a maximum amount of active chlorine is influenced by the presence of oxygen. When lime is completely hydrated and left in contact with air, after some time it exhibits the reactions of peroxides—blue coloration with guaiacum resin, red coloration with ferrous sulphate and potassium thiocyanate, and blue coloration with chromic acid and ether. In the formation of bleaching powder, the chlorine acts on the water yielding hydrogen chloride and oxygen, the latter then converting a part of the lime into calcium peroxide:  $4\text{Cl} + 2\text{H}_2\text{O} = 4\text{HCl} + \text{O}_2$ ;  $\text{CaO}, \text{H}_2\text{O} + \text{O}_2 = \text{CaO}_2, \text{H}_2\text{O}_2$ ;  $\text{CaO}_2, \text{H}_2\text{O}_2 + 2\text{HCl} = \text{CaO}_2\text{Cl}_2 + 2\text{H}_2\text{O}$ .

The author's experiments indicate that hypochlorites must, in general, be regarded as chlorides of peroxides, and that bleaching powder containing 44.09 per cent. of chlorine (which is the maximum proportion obtainable in the commercial product) is the chloride of



calcium peroxide *plus* 1 mol. of water,  $\text{Ca}(\text{OCl})_2 \cdot \text{H}_2\text{O}$ . This constitution for bleaching powder is in accord with its action on mercury, which is converted quantitatively into mercuric chloride:  $\text{CaO}_2\text{Cl}_2 + \text{Hg} = \text{CaO}_2 + \text{HgCl}_2$ . This method is the subject of a patent for the manufacture of corrosive sublimate. T. H. P.

**Action of Water on the Phosphates of Calcium.** FRANK K. CAMERON and ATHERTON SEIDELL (*J. Amer. Chem. Soc.*, 1904, 26, 1454—1463. Compare Rindell, *Abstr.*, 1902, ii, 208).—A study has been made of the extent to which the three calcium phosphates are decomposed by water, and experiments have been made to ascertain the effect of calcium sulphate, calcium carbonate, and carbon dioxide on the hydrolysis. Since tricalcium phosphate and monocalcium phosphate always contain an excess of either base or acid, the results of the solubility determinations cannot be regarded as of absolute value, but are useful as indicating the nature of the reaction between the phosphates and water.

In each experiment, a weighed quantity of the phosphate was placed in a bottle with distilled water and maintained for several weeks at  $25^\circ$  with occasional shaking. Portions of the clear solutions were withdrawn and the amounts of calcium and phosphoric acid in them were estimated. The results show that tricalcium and monocalcium phosphates both undergo considerable decomposition, but that dicalcium phosphate is more stable and only slightly decomposed by water. In the case of the mono- and tri-calcium phosphates, the amount of decomposition and the concentration of the resulting solution are found to depend on the relative proportions of phosphate and water employed.

In presence of calcium sulphate, the amount of phosphoric acid dissolved from tricalcium phosphate is increased. A slight increase also takes place with monocalcium phosphate, but a considerable decrease occurs in the amount of phosphoric acid dissolved from the dicalcium salt.

In presence of calcium carbonate, the amount of phosphoric acid dissolved is decreased in all three cases.

Carbon dioxide causes an increased quantity of phosphoric acid to be dissolved from tri- or di-calcium phosphate, but is without effect on the action of water on the monocalcium salt. E. G.

**Action of Amalgams on Solutions.** GUSTAVE FERNEKES (*J. Physical Chem.*, 1904, 8, 566—570).—A reply to some criticisms by G. McP. Smith (*Abstr.*, 1904, ii, 400) of the author's explanation of the action of amalgams on water (*Abstr.*, 1904, ii, 163). The author adds the results of some further experiments. It was first shown that barium is not replaced in its amalgam by either sodium or potassium when acted on by a concentrated solution of a salt. It was found, however, that barium amalgam reacts with water about three times as quickly as with a solution of potassium chloride. This is readily explicable on Kahlenberg's theory, as each molecule of the salt would influence the surrounding water molecules. Molecular quantities of

sodium and potassium chlorides were also allowed to act on sodium amalgam for 15 minutes, at the end of which time the amalgam was found to contain only potassium; this fact and also the anomalous behaviour of sodium hydroxide solutions are not explicable by the ionic theory.

L. M. J.

**Equilibrium in the System  $\text{GlO}:\text{SO}_3:\text{H}_2\text{O}$ .** CHARLES L. PARSONS (*J. Amer. Chem. Soc.*, 1904, 26, 1433—1446).—It is found that the only definite hydrated sulphates of glucinum are  $\text{GlSO}_4 \cdot 4\text{H}_2\text{O}$  and  $\text{GlSO}_4 \cdot 2\text{H}_2\text{O}$ , no evidence being obtainable of the existence of the heptahydrate described by Klatzo (*Zeit. Chem.*, 1869, 12, 129). The tetrahydrate has an aqueous vapour pressure equal to or greater than the pressure of its own water of crystallisation; it has been found by tensimeter experiments that this pressure over phosphoric oxide at  $20^\circ$  is equivalent to 20 mm. of olive oil, and increases rapidly with the temperature. The dihydrate is stable in the air at the ordinary temperature, but loses water slowly at  $100\text{--}110^\circ$ . The anhydrous sulphate cannot be obtained quite pure on account of the difficulty of removing the last traces of water without incurring the loss of sulphur trioxide.

An examination of the various so-called basic sulphates of glucinum has shown that these substances are not definite compounds, but consist of solid solutions of the sulphate in the hydroxide. E. G.

**Zincum Boricum or Oxyboricum.** E. HOLDERMANN (*Arch. Pharm.*, 1904, 242, 567—568).—When a solution of zinc sulphate and another of borax are mixed in varying proportions, the second solution containing also just enough sodium hydroxide to complete the conversion of the sulphate into sodium sulphate, the filtrate gives no further precipitate with either solution when the zinc sulphate and borax have been mixed in the proportion of 3:2 mols. The composition of the precipitate, therefore, is  $\text{Zn}_3(\text{B}_4\text{O}_7)_2(\text{OH})_2$ .

C. F. B.

**The Complexity of Dissolved Sulphates.** ALBERT COLSON (*Compt. rend.*, 1904, 139, 857—859. Compare Abstr., 1904, ii, 377, 532).—A solution of copper sulphate containing 0.75 gram-mol. in 2 litres gave a depression of the freezing point of  $0.70^\circ$ , whilst the sulphuric acid solution, obtained by exactly precipitating the copper in the same solution by hydrogen sulphide, gave a depression of  $1.51^\circ$ , at least twice  $0.70^\circ$ ; it follows, therefore, that the second solution contains twice as many molecules as the first, and the molecular complexity of copper sulphate in solution is represented by the formula  $(\text{CuSO}_4)_2$ , and similar results were obtained in the case of magnesium sulphate. The author suggests that the sulphates of the bivalent metals in aqueous solution have the formula  $(\text{HSO}_4\text{M})_2\text{O}$ , and may be regarded as being formed by the condensation of 2 mols. of sulphuric acid with the hydroxide,  $(\text{OH}\cdot\text{M})_2\text{O}$ ; this explains the acidic nature of the metallic sulphates. On the other hand, the metallic hydroxides are sufficiently strong bases to displace sodium or ammonium hydroxide from solutions of their sulphates, for when a solution of sodium sulphate is added to zinc oxide neutral to phenolphthalein suspended in water, the mixture becomes increasingly alkaline towards the indi-

cator owing to the liberation of sodium hydroxide and the formation of the basic salt,  $\text{SO}_4(\text{Zn}\cdot\text{O}\cdot\text{ZnOH})_2$ ; similarly, a blue coloration is developed when copper oxide is added to a solution of ammonium sulphate. M. A. W.

**A New Cause of Dissociation of Mercuric Chloride and its Influence on the Antiseptic Properties of Solutions of Corrosive Sublimate.** HENRI VITTENET (*Bull. Soc. chim.*, 1904, [iii], 31, 1133—1138).—When equal parts of ammonium and mercuric chlorides are dissolved in tap-water, there slowly forms a precipitate, which is at first white and has the composition  $\text{N}(\text{HgCl})_3$ , but on further standing gradually becomes yellow. The production of this substance was traced to the presence of acid carbonates in the water, and its formation was found to be inhibited by previous ebullition of this. When the two salts are dissolved in distilled water to which sodium hydrogen carbonate or carbonate has been added, the precipitate formed is white and has the composition  $\text{N}(\text{HgCl})_3\cdot 3\text{NH}_4\text{Cl}$ , but gradually becomes yellow when washed with water, and the final product is bright yellow and has approximately the composition required by the formula  $\text{N}(\text{Hg}\cdot\text{OH})_2\cdot\text{Hg}\cdot\text{OCl}$ . The formation of these precipitates in such solutions used as antiseptic baths leads to a diminution of efficiency, and it is suggested that in preparing these the water should first be boiled or the ammonium chloride should be replaced by sodium chloride; with either of these precautions, no precipitation occurs. T. A. H.

**Yttrium Earth related to Gadolinium.** GEORGES URBAIN (*Compt. rend.*, 1904, 139, 736—738).—By means of three separate methods of fractional crystallisation, the author has obtained from the yttrium earths 100 grams of a rare earth, which consists chiefly of the oxide of Lecoq de Boisbaudran's new element  $\text{Z}\delta$  (compare Abstr., 1896, ii, 249; also Demarçay, Abstr., 1900, ii, 656). The methods employed were: (i) Fractional crystallisation of the double nitrates of the rare earths and of nickel. The fractions containing the element  $\text{Z}\delta$  were intermediate between those of gadolinium and dysprosium. (ii) Fractional crystallisation of the nitrates of the earths in the presence of bismuth nitrate (compare Abstr., 1904, ii, 37, 43, 173; also Demarçay, Abstr., 1900, ii, 347). The nitrate of  $\text{Z}\delta$  has the same solubility as bismuth nitrate. (iii) Fractional crystallisation of the ethyl sulphates of the rare earths (compare Abstr., 1900, ii, 346). The earth thus separated exhibits only the absorption band  $\lambda = 488$  characteristic of  $\text{Z}\delta$ , but this does not preclude the possibility of  $\text{Z}\delta$  being a mixture of elements some of which possess no absorption spectra. M. A. W.

**Neodymium Oxide.** ANTON WAEGNER (*Zeit. anorg. Chem.*, 1904, 42, 118—126. Compare Abstr., 1903, ii, 729).—That very varying statements have been made as to the colour of neodymium oxide,  $\text{Nd}_2\text{O}_3$ , is probably due to the oxide under investigation having been in many cases contaminated with other rare earths, and particularly with praseodymium.

The crude neodymium chloride used by the author, which contained traces of praseodymium and lanthanum, was converted into the



oxalate; this, when carefully heated in a platinum boat in a current of oxygen, formed a pink residue from which carbon dioxide could be obtained at a higher temperature. When the oxalate is heated at a bright red heat, an oxide of the probable composition  $\text{Nd}_4\text{O}_7$  is formed; prepared in this manner, it is brownish-pink and resembles Brauner's oxide,  $\text{Nd}_2\text{O}_3$ , in being converted by prolonged heating with the blowpipe or in a current of hydrogen into the oxide  $\text{Nd}_2\text{O}_3$ . Further, its brown tint is due to a trace of praseodymium peroxide, since, when heated moderately in a current of hydrogen, the traces of praseodymium peroxide are reduced to sesquioxide, and the true colour of the neodymium oxide, namely, a sky-blue colour with a violet tint, is rendered evident.

The existence of a higher neodymium oxide was also rendered probable by the spectrometric observations with the two oxides. The spectrum from the oxide  $\text{Nd}_2\text{O}_3$  is quite different from that of the oxide  $\text{Nd}_4\text{O}_7$ .

A. McK.

**Deposition of Aluminium from Ethyl Bromide Solution.** HARRISON E. PATTEN (*J. Physical Chem.*, 1904, 8, 548—565).—It has been shown by Plotnikoff (Abstr., 1902, ii, 639) that aluminium bromide dissolved in ethyl bromide yields a conducting solution from which aluminium may be deposited, and the author has further studied this deposition. In a 4.38 per cent. solution, no aluminium was deposited even with currents of fairly high density; evidence was, however, obtained of the formation of protective films on the aluminium, and this in a solution which was almost perfectly free from oxygen. In a solution of 40.95 per cent. of aluminium bromide, aluminium was deposited when the current density reached 0.0023 ampere per sq. cm.; the electrolytic metal reacts on the solution vigorously, a gas, probably butane, being evolved; below the current density given, the rate of dissolution exceeds that of deposition. The potential of the aluminium against the solution was 1.10 volts, and that of the bromine was -1.20 volts. Using the aluminium as anode, further evidences of film formation were obtained, but no high counter-pressures were obtained.

During the work, aluminium bromide was obtained in the form of large, rhombohedral crystals of a pale yellow colour.

L. M. J.

**Stimulating and Paralysing Influences of certain Substances in the Production of Rust.** LÉON LINDET (*Compt. rend.*, 1904, 139, 859—862).—The catalytic action exercised by certain metals on the oxidation of organic compounds has been studied by Livache (Abstr., 1883, 756; 1884, 532), by Trillat (Abstr., 1903, i, 222; ii, 201, 589; 1904, ii, 38), and by Duchemin and Dourlen (Abstr., 1904, i, 961). The author finds that the rusting of iron is accelerated by the presence of copper, and retarded by such metals as tin, lead, zinc, manganese, aluminium, or magnesium; the phenomena are to be attributed to the hydroxide of the metal which dissolves in the water, for similar stimulating or paralysing effects are produced on the iron by water which has been in contact with the metal. Arsenic and its compounds exercise a paralysing effect on the rusting of iron, and when present in large quantities stop it altogether; in this case the dissolved

iron hydroxide forms colloidal, ferrous, or ferric arsenite. Soluble salts such as the chlorides and sulphates of the alkali metals have a stimulating effect on the rusting of iron, probably due to their electrolytic dissociation, whilst among organic substances such compounds as sugar, phenol, or resorcinol stimulate the formation of rust; alcohol or methyl salicylate has a retarding effect, and acetic or salicylic acid dissolves the iron as rapidly as it is oxidised.

M. A. W.

**Colloidal Ferric Hydroxide.** A. V. DUMANSKY (*J. Russ. Phys. Chem. Soc.*, 1904, 36, 1067—1069).—The colloidal ferric hydroxide examined was prepared by saturating a solution of ferric chloride with ammonium carbonate and purifying the solution obtained by dialysis. The liquids thus prepared contain as much as 5.3 grams of ferric oxide per litre, but no iron ions are present; the solution also contains chlorine, probably in combination with ammonia. On electrolysis, or with electrolytes such as barium hydroxide, potassium thiocyanate, hydrochloric acid, zinc sulphate, &c., the solution is coagulated, but with mercuric or mercurous nitrate or ferric chloride it forms first a complex colloid; besides this, salts of mercury or copper convert a part of the iron into salts of their acids. By ammoniacal solution of copper oxide, the colloid is precipitated together with cupric oxide, whilst in the presence of organic hydroxy-acids and on heating, the cupric oxide is reduced to cuprous oxide; the same occurs with ammoniacal silver oxide solution. When the solution is boiled with Fehling's solution, the colloid is precipitated together with cuprous oxide.

T. H. P.

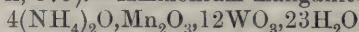
**Perchromic Acid and the Perchromates.** HORACE G. BYERS and E. EMMET REID (*Amer. Chem. J.*, 1904, 32, 503—513).—The blue compound produced when chromic acid is treated with hydrogen peroxide has been the subject of numerous investigations, and various formulæ have been assigned to it. Recently Patten (*Abstr.*, 1903, ii, 431) has stated that this substance is not perchromic acid, but that the chromium is present in the chromous state.

When the ethereal solution of the blue compound is treated with potassium at  $-20^{\circ}$ , hydrogen is evolved and a purplish-black precipitate is produced. This compound, which has the composition  $\text{KCrO}_4$  or  $\text{K}_2\text{Cr}_2\text{O}_8$ , is unstable, and rapidly decomposes with evolution of oxygen and formation of potassium dichromate. By the addition of an alcoholic solution of potassium cyanide to the blue solution, Wiede (*Abstr.*, 1898, ii, 295) obtained a similar compound to which he ascribed the formula  $\text{KCrO}_5\cdot\text{H}_2\text{O}_2$ . When the blue solution is prepared without employing an excess of hydrogen peroxide, the compound obtained on the addition of potassium cyanide has the same composition as that produced by the action of potassium. The corresponding sodium, ammonium, lithium, magnesium, calcium, barium, and zinc salts were prepared.

A study of the blue ethereal solution has shown that it contains perchromic acid,  $\text{H}_2\text{Cr}_2\text{O}_8$ . When the solution is prepared in presence of an excess of hydrogen peroxide, it is probable that a more highly oxidised compound is also produced.

E. G.

**Derivatives of Complex Inorganic Acids.** ALLEN ROGERS and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1904, **26**, 1474—1484. Compare Abstr., 1903, ii, 375).—Ammonium manganitungstate,

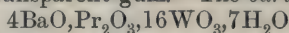


(Brubaker, *Thesis*, 1904), prepared by boiling ammonium paratungstate and manganic hydroxide with water, forms large, red, octahedral crystals and is very soluble in water.

*Ammonium nickelitungstate*,  $3(\text{NH}_4)_2\text{O}, \text{Ni}_2\text{O}_3, 16\text{WO}_3, 22\text{H}_2\text{O}$ , obtained by boiling the hydrated sesquioxide of nickel with an ammoniacal solution of ammonium paratungstate, forms a greenish-white crystalline powder and is sparingly soluble in water. On adding barium chloride to a solution of this salt, *barium nickelitungstate*,  $19\text{BaO}, \text{Ni}_2\text{O}_3, 16\text{WO}_3$ , is produced as a white precipitate. When ammonia is passed into the solution of ammonium nickelitungstate, another *ammonium* salt,  $(\text{NH}_4)_2\text{O}, \text{Ni}_2\text{O}_3, 4\text{WO}_3, 7\text{H}_2\text{O}$ , is obtained which is dark blue when moist, but of a light blue colour when dry.

The following compounds were prepared by boiling the respective hydroxides with an aqueous solution of ammonium paratungstate for 8 hours, filtering, and evaporating the filtrate to dryness on the water-bath. When dry, all the salts were quite insoluble.

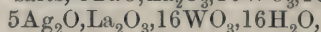
*Ammonium praseodymitungstate*,  $2(\text{NH}_4)_2\text{O}, \text{Pr}_2\text{O}_3, 16\text{WO}_3, 16\text{H}_2\text{O}$ , is obtained as a green, transparent gum. The *barium* salts,



and  $6\text{BaO}, \text{Pr}_2\text{O}_3, 16\text{WO}_3, 9\text{H}_2\text{O}$ , form white powders. The *silver* salt,  $4\text{Ag}_2\text{O}, \text{Pr}_2\text{O}_3, 16\text{WO}_3, 8\text{H}_2\text{O}$ , is of a greenish-white colour.

*Ammonium neodymitungstate*,  $3(\text{NH}_4)_2\text{O}, \text{Nd}_2\text{O}_3, 16\text{WO}_3, 20\text{H}_2\text{O}$ , and the *barium* salt,  $6\text{BaO}, \text{Nd}_2\text{O}_3, 16\text{WO}_3, 17\text{H}_2\text{O}$ , are of a pink colour.

*Ammonium lanthanitungstate*,  $2(\text{NH}_4)_2\text{O}, \text{La}_2\text{O}_3, 16\text{WO}_3, 16\text{H}_2\text{O}$ , and the *barium* and *silver* salts,  $5\text{BaO}, \text{La}_2\text{O}_3, 16\text{WO}_3, 16\text{H}_2\text{O}$  and



form white powders.

*Ammonium ceritungstate*,  $2(\text{NH}_4)_2\text{O}, \text{Ce}_2\text{O}_3, 16\text{WO}_3, 2\text{H}_2\text{O}$ , is obtained as a red, transparent glass. E. G.

**Uranyl Chloride.** WILLIAM ECHSNER DE CONINCK (*Ann. Chim. Phys.*, 1904, [viii], **3**, 500—506. Compare Abstr., 1901, ii, 164).—Aqueous solutions of uranyl chloride have the following sp. gr. :

Percentage of dissolved salt.	Sp. gr.	Temperature.	Percentage of dissolved salt.	Sp. gr.	Temperature.
1	1.0056	14.6°	6	1.0313	15.2°
2	1.0112	16.3	7	1.0366	14.3
3	1.0161	13.7	8	1.0418	14.5
4	1.0215	13.1	9	1.0469	15
5	1.0260	14.2	10	1.0517	14.8

When uranyl chloride is heated in dry air, it is decomposed into chlorine and the dioxide,  $\text{UO}_2$ , which is oxidised to the higher oxides,  $\text{UO}_3$  and  $\text{U}_3\text{O}_8$ , and is similarly decomposed when heated with



calcium hydroxide or calcium oxide, the final products being calcium uranate or a mixture of calcium uranate and diuranate [pyrouranate?], and similar results were obtained with barium or strontium oxides or hydroxides. By the action of fused potassium or sodium hydroxide, uranyl chloride is converted into a mixture of the alkali chloride and diuranate [pyrouranate?] together with a little alkali uranate; the alkali diuranates [pyrouranates?] are insoluble in water, but soluble in dilute nitric acid. By the action of sulphuric, nitric, or selenic acid, uranyl chloride yields uranyl sulphate, nitrate, or selenite respectively, and it is reduced to uranous oxide,  $\text{UO}_2$ , by the action of hydrogen, hydrogen sulphide, zinc dust, or iron filings at a high temperature. A neutral aqueous solution of uranyl chloride gives the following qualitative reactions: with potassium hydroxide, an orange precipitate; with ammonia or methylamine, a yellow precipitate insoluble in excess of the reagent; with sodium hydrogen carbonate, an evolution of carbon dioxide and no precipitate; with potassium or sodium carbonate or sodium phosphate or potassium cyanide, a yellow, gelatinous precipitate insoluble in excess of the reagent; with ammonium sulphide, a brown precipitate becoming red; with hydrogen sulphide, a slight brown precipitate after 24 hours; with potassium ferrocyanide or ferricyanide, a deep reddish-brown precipitate insoluble in excess of the reagent.

M. A. W.

**Tin Amalgams.** WILLEM J. VAN HETEREN (*Zeit. anorg. Chem.*, 1904, 42, 129—173).—In the liquid state, tin and mercury are miscible in every proportion.

The points at which such mixtures solidify rise from tin to mercury and form two curves, the first from  $231.6^\circ$  to  $-34.5^\circ$  for concentrations of 100—0.3 atomic percentage of tin, the second from  $-34.5^\circ$  to  $-38.6^\circ$  for concentrations of 0.3—0 atomic percentage of tin.

The first curve is almost a straight line until  $120^\circ$ , when it gradually bends till  $40^\circ$  is reached, at which point it falls almost perpendicularly along the temperature axis. Consequently at low temperatures the amount of tin in the saturated liquid amalgams is exceedingly small. From the liquid amalgams, represented by this curve, either pure tin separates or tin with very little mercury. The solid phase at  $25^\circ$  contained 94 per cent. of tin as determined analytically and 99 per cent. as determined by electrical means.

The potential differences of amalgams of from 0.001 to 100 per cent. of tin were measured at  $25^\circ$  against an amalgam with 15.95 per cent. With the liquid amalgams, the potential difference increases rapidly the higher the amount of tin until the saturation point with 1.2 per cent. of tin is reached. Contrasted with pure tin, the difference is about 0.5 millivolt more. By comparison of the potential differences at  $25^\circ$  and  $50^\circ$  respectively, the deduction is made that at  $25^\circ$  the conversion of 1 gram atom of tin into liquid amalgam with 0.01 to 1.00 atomic percentage of tin, that is, almost pure mercury, involves an amount of heat equal to about 3000 calories.

Amalgams containing 0.3 to 85 atomic percentage of tin exhibit at  $-34.5^\circ$  a transformation which, with the addition of heat, is accompanied by contraction. A new solid phase results, mixed crystals being

probably produced where the tin may be supposed to exist in a form unknown in the free state. Between  $-34.5^{\circ}$  and  $-38.6^{\circ}$  those mixed crystals separate and an expansion occurs, which decreases when the percentage of tin is considerable and disappears with an atomic percentage of 60 to 70 of tin.

All amalgams up to 60 per cent. of tin solidify at  $-38.6^{\circ}$ .

A. MCK.

**Stannichlorides of the Types  $M_2'SnCl_6$  and  $M''SnCl_6$ . II.** EUGEN VON BIRON (*J. Russ. Phys. Chem. Soc.*, 1904, **36**, 933—947. Compare Abstr., 1904, ii, 567).—On repeating the experiments of Engel (Abstr., 1897, ii, 376; 1898, ii, 29, 119), the author obtains tin meta- and para-chlorides having properties identical with the products obtained by Engel. The meta-chloride differs slightly in composition from that prepared by this author.

From the results obtained, together with those of other investigators, the following conclusions are drawn. When  $\alpha$ -stannic acid undergoes change, it yields an uninterrupted series of varieties of  $\beta$ -stannic acid, differing as regards their degree of condensation, which becomes greater as the temperature rises. The action of hydrochloric acid on these various  $\beta$ -stannic acids gives rise to oxychlorides which have an indefinite composition and contain a larger or smaller proportion of chlorine according as the condensation of the  $\beta$ -acid is small or great. The oxychlorides, differing considerably in composition, exhibit differences in properties similar to those shown by the tin meta- and para-chlorides of Engel. The reverse reactions, by which the oxychlorides are converted into a derivative of the  $\alpha$ -acid, namely, stannic chloride, proceed the more readily the less the condensation.

T. H. P.

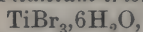
**Stannates.** ITALO BELLUCCI and N. PARRAVANO (*Atti R. Accad. Lincei*, 1904, [v], **13**, ii, 339—346. Compare Abstr., 1904, ii, 823).—Lead stannate,  $PbSn(OH)_6$ , is obtained as a white, amorphous precipitate and loses  $3H_2O$  on heating to redness. The barium ( $+4H_2O$ ), calcium, and strontium salts were also prepared and analysed. All these salts are of the type  $X'Sn(OH)_6$ , and contain a far more stable complex than the stannichlorides (see Abstr., 1904, ii, 822). This greater stability of the stannates is borne out by conductivity measurements of solutions of potassium stannate.

T. H. P.

**Titanium. I. Hydrates of Titanium Trihaloids.** ARTHUR STÄHLER (*Ber.*, 1904, **37**, 4405—4410).—The author was unable to obtain the green compound,  $TiCl_3 \cdot 4H_2O$ , described by Glatzel (this Journal, 1877, i, 688).

Titanium trichloride hexahydrate,  $TiCl_3 \cdot 6H_2O$ , prepared by the electrolytic reduction of the tetrachloride, is violet. *Titanium rubidium chloride*,  $TiCl_3 \cdot 2RbCl \cdot H_2O$ , prepared by passing hydrogen chloride into an aqueous solution of a mixture of rubidium and titanium chlorides, which was heated on the water-bath, is green and

forms a violet solution with water. *Titanium cæsium chloride*,  $\text{TiCl}_3 \cdot 2\text{CsCl} \cdot \text{H}_2\text{O}$ , is green. *Titanium tribromide hexahydrate*,



prepared by the electrolytic reduction of titanium tetrabromide, is violet and more unstable than the corresponding chloride. *Titanium tri-iodide hexahydrate*,  $\text{TiI}_3 \cdot 6\text{H}_2\text{O}$ , prepared by the electrolytic reduction of titanium tetraiodide, is violet and very unstable. A. McK.

**Zirconium Salts. Constitution of Normal Zirconium Sulphate.** RUDOLF RUER (*Zeit. anorg. Chem.*, 1904, 42, 87—99).—Normal zirconium sulphate does not give the characteristic reactions with oxalic acid and ammonium oxalate respectively such as the chloride gives. These reactions do not take place with solutions of zirconium oxychloride to which normal ammonium sulphate or sodium sulphate is added. The conclusion is drawn, accordingly, that zirconium sulphate in aqueous solution is constitutionally different from zirconium chloride or nitrate; its behaviour in aqueous solution is best expressed by formulating it as  $\text{ZrOSO}_4 \cdot \text{H}_2\text{SO}_4$ . Since this compound is represented as a dibasic acid, it forms sodium and ammonium salts of the type  $\text{ZrOSO}_4 \cdot \text{SO}_4 \text{M}_2$ , the complete electrolytic dissociation of which is represented by  $\text{ZrOSO}_4 \cdot \text{M}_2\text{SO}_4 = \text{ZrOSO}_4 \cdot \text{SO}_4'' + 2\text{M}^+$ , zirconium being present in the complex anion.

The constitution of crystalline zirconium sulphate is very probably  $\text{ZrOSO}_4 \cdot \text{H}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ , and not  $\text{Zr}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ .

Complex formation with concentrated solutions of sodium salts, such as sodium chloride and sodium nitrate, was also noted. In such complex salts, the zirconium is present in the cathion.

Zirconium oxychloride in aqueous solution is gradually decomposed when left at the ordinary temperature or when heated. A. McK.

**Red Derivatives of Hydrated Vanadium Trichloride.** ARTHUR STÄHLER (*Ber.*, 1904, 37, 4411—4412).—*Vanadium rubidium chloride*,  $\text{VdCl}_5 \cdot \text{Rb}_2 \cdot \text{H}_2\text{O}$ , prepared by evaporating a solution of hydrated vanadium chloride saturated with hydrogen chloride, forms a red, crystalline powder which is sparingly soluble in water. Similar ammonium, potassium, and cæsium compounds were obtained; the magnesium compound has the composition  $\text{VdCl}_5 \cdot \text{Mg} \cdot \text{H}_2\text{O}$ . These substances are probably analogous to the chromium derivative  $\text{CrCl}_5(\text{OH}_2) \cdot \text{Rb}_2$  (Werner and Gubser, *Abstr.*, 1901, ii, 453).

W. A. D.

**Purification of Sodium Vanadate Liquors; the Processes of Double Decomposition for the Industrial Separation of Metals.** H. HERRENSCHMIDT (*Compt. rend.*, 1904, 139, 862—864).—In the separation of vanadic acid from the mixture of sodium vanadate and silicate (compare *Abstr.*, 1904, ii, 824), the use of sulphuric acid is to be avoided as it necessitates a concentration of the liquors, introduces a third substance, namely, sodium sulphate, which has to be removed, and precipitates the vanadic acid with the silica, whereas the addition of a slight excess of vanadic acid to the dilute



solution of sodium vanadate and silicate causes the complete precipitation of the silica, the vanadic acid remaining in solution.

In all cases of separation of metals, the author recommends the use as a reagent of a compound of one of the metals already present; thus the separation of iron from manganese is effected by the carbonate or sesquioxide of manganese according to the state of oxidation of the metals in solution.

M. A. W.

**Preparation of Aurous Iodide by the Action of Iodine on Gold.** FERNAND MEYER (*Compt. rend.*, 1904, 139, 733—736).—Pure dry iodine has no action on gold at the ordinary temperature, but combines with it to form green, amorphous aurous iodide,  $\text{AuI}$ , at temperatures between  $50^\circ$  and the melting point of iodine; at higher temperatures, the iodide is obtained in the form of lemon-yellow, crystalline plates, but the reaction is reversible, and at  $190^\circ$  the iodide is completely decomposed into iodine and gold. In order to free aurous iodide from uncombined iodine, it is heated at  $30^\circ$ , whereby the latter is volatilised, it being impossible to employ any solvent for this purpose, as alcohol, ether, chloroform, or benzene decomposes the iodide. In the presence of water in a closed vessel, iodine reacts with gold to form aurous iodide provided the iodine is in excess.

M. A. W.

**Volatilisation of Platinum.** GEORGE A. HULETT and H. W. BERGER (*J. Amer. Chem. Soc.*, 1904, 26, 1512—1515).—An account is given of a series of experiments carried out with the object of determining the conditions under which platinum is volatilised. A large sheet of platinum foil was heated by means of an electric furnace and the loss in weight determined at intervals. In order to ascertain whether the volatilisation was influenced by the impurities present, some experiments were made with a specimen of platinum of a high degree of purity; the results showed that the pure platinum behaved in the same way as the foil.

Platinum begins to volatilise in air at a temperature of about  $800^\circ$  and the rate of loss increases rapidly as the temperature rises. No volatilisation occurs when the metal is heated in the absence of oxygen, and it is suggested, therefore, that at high temperatures the platinum is converted into a volatile oxide which undergoes decomposition at temperatures below  $800^\circ$ .

E. G.

**Absorption of Hydrogen by Rhodium.** L. QUENNESSEN (*Compt. rend.*, 1904, 139, 795—796).—Wilm's statement (*Abstr.*, 1881, 514) that hydrogen is more readily absorbed by rhodium than by palladium is contradicted. Rhodium was purified by heating it with sodium chloride in a current of chlorine, dissolving the product in water, converting into sodium rhodium nitrite, and crystallising the latter. The metal regenerated from this does not absorb a measurable amount of hydrogen when heated and cooled in a current of the gas. It acts as a catalyser in promoting the union of hydrogen and oxygen.

H. M. D.

**Iridium Sesquisulphate and its Alums.** LUIGI MARINO (*Zeit. anorg. Chem.*, 1904, **42**, 213—224. Compare Abstr., 1903, ii, 376).—Iridium sesquisulphate,  $\text{Ir}_2(\text{SO}_4)_3 \cdot x\text{H}_2\text{O}$ , is prepared by crystallisation from a solution of the hydrated sesquioxide in dilute sulphuric acid in the absence of air.

*Iridium cæsium alum*,  $\text{Ir}_2(\text{SO}_4)_3 \cdot \text{Cs}_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$ , separates in regular octahedra, crystallographic measurements of which are quoted. Its aqueous solution is yellow and becomes pink when warmed above  $40^\circ$ . It melts at  $109\text{--}110^\circ$  to a yellowish-red liquid.

*Iridium rubidium alum* (*loc. cit.*) is less soluble than the cæsium alum; it melts at  $108\text{--}109^\circ$  to a yellowish-red liquid.

*Iridium potassium alum*,  $\text{Ir}_2(\text{SO}_4)_3 \cdot \text{K}_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$ , forms yellow octahedra and melts at  $102\text{--}103^\circ$ .

*Iridium ammonium alum*,  $\text{Ir}_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$ , forms yellowish-red octahedra and melts at  $105\text{--}106^\circ$  to a reddish-violet liquid. When it is heated at a red heat, iridium is formed.

*Iridium thallium alum*,  $\text{Ir}_2(\text{SO}_4)_3 \cdot \text{Tl}_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$ , forms golden-yellow octahedra. A. McK.

## Mineralogical Chemistry.

**Origin of Naphtha.** K. W. CHARITSCHKOFF (*J. Russ. Phys. Chem. Soc.*, 1904, **36**, 1091—1096).—The author discusses the bearing of the results of Rakusin (Abstr., 1904, i, 641) on the “organic” and “inorganic” theories of the origin of naphtha (see also Charitschkoff, Abstr., 1904, ii, 180). He gives also analyses of gases evolved from the marshy volcanoes of the Caucasus. T. H. P.

**Investigation of the Cañon Diablo Meteorite.** HENRI MOISSAN (*Compt. rend.*, 1904, **139**, 773—780. Compare Abstr., 1893, ii, 288).—A block of the meteoric iron weighing 183 kilograms was cut through. Whilst one half of the section (area =  $625\text{ cm}^2$ ) appeared to be homogeneous and had the colour and brilliancy of iron, the other half revealed the presence of five large elliptical nodules and three smaller ones. The nodules are of a grey or black colour and extremely hard; under the microscope, they have a markedly crystalline appearance. Analyses of (I) the matrix, (II) the nodules, gave:

	Fe.	Ni.	Co.	Mg.	S.	P.	Si.	C.	Insol. in hot HCl.
I.	95.37	3.945	—	—	trace	0.144	trace	not det.	0.260
II.	66.95	1.93	trace	trace	22.15	2.37	trace	1.96	—
	67.51	1.77	—	trace	19.91	2.30	trace	—	—

From the residue insoluble in hydrochloric acid, crystals of iron phosphide,  $\text{Fe}_3\text{P}_2$ , have been separated. Amorphous carbon, graphite, diamond (black and transparent), and carbon silicide were also found in this residue.

The authors suggest that the nodules were originally nodules of cementite which have been acted on at a later period by the sulphur with separation of carbon. According to Le Chatelier and Ziegler's experiments, sulphide of iron can diffuse readily through masses of iron.

H. M. D.

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## Physiological Chemistry.

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**Micro-respirometric Investigations.** TORSTEN THUNBERG (*Centr. Physiol.*, 1904, 18, 553—556).—The question whether nerves participate in respiratory activity has been answered in the affirmative by Baeyer, Fröhlich, and others, in confirmation of Waller's long-expressed opinion (which, however, is not quoted) that carbon dioxide is produced during the activity of nerve fibres. By means of an apparatus termed the "micro-respirometer," previously described in a Swedish publication (*Upsala Läk. s. Förh.*, 1902—1904), the respiratory exchanges in small objects like nerves can be actually measured. A number of results are given, as also are some in which the exchanges in small animals like snails were estimated.

W. D. H.

**Excretion of Carbon Dioxide during Exercise.** GEORGE O. HIGLEY and W. P. BOWEN (*Amer. J. Physiol.*, 1904, 12, 311—335).—An instrument called the chemograph is described for obtaining a graphic record of carbon dioxide excretion in man. At the beginning of work (bicycling), the amount excreted rises after a latent period of about 20 seconds; the maximum is reached in about 2 minutes; if the work remains uniform, the output of carbon dioxide then remains uniform also, and on the cessation of work there is a latent period again of about 20 seconds, followed by a fall to the normal in about 2 minutes. There is apparently no connection between carbon dioxide production and the secondary rise of pulse rate which occurs.

W. D. H.

**Passage of Food-stuffs from the Stomach and through the Small Intestine.** W. B. CANNON (*Amer. J. Physiol.*, 1904, 12, 387—418).—A continuation and amplification of the author's previous work by means of the Röntgen rays; the method is capable of yielding data on the rate of peristalsis and of segmentation into masses. This is most rapid with carbohydrate food. Carbohydrates reach the large intestine in 4, fats in 5, and proteids in 6 hours. Data are also given when these different kinds of food are mixed or administered in succession. The animals used were cats.

W. D. H.

**Influence of Surgical Operations on Carbohydrate Metabolism.** EDUARD PFLÜGER, BERNHARD SCHÖNDORFF, and FRIEDRICH WENZEL (*Pflüger's Archiv*, 1904, 105, 121—176).—Gly-



cosuria is often described as a common sequel to surgical operations. The grounds for this opinion are not regarded as satisfactory; the urine may contain a reducing substance, but this is not necessarily sugar. A discussion follows (largely polemical) concerning the best tests for sugar in urine. Even the fermentation test is untrustworthy. Most reliance should be placed on the polarimetric test and Worm-Müller's modification of the copper test. From the examination of some hundreds of urines, the conclusion is drawn that many forms of so-called transitory glycosuria (including those produced surgically and by anæsthesia) do not exist.

W. D. H.

**The Behaviour of Carbohydrates in Autolysis.** CARL NEUBERG and RICHARD MILCHNER (*Chem. Centr.*, 1904, ii, 1422; from *Berlin klin. Woch.*, 41, 1081—1084).—In autolysis of the liver, the proteid matter of which contains 3.6 per cent. of glucosamine, no hydrolysis of the latter takes place with the liberation of a unimolecular sugar. On the other hand, in autolysis of the pancreas, *L*-xylose is liberated from the nucleo-proteid; in this, autolysis differs from tryptic digestion. It is believed that the pentose group is united not to the proteid molecule, as is the glucosamine of liver proteid, but to the nucleic acid of the pancreatic proteid (guanylic acid) after the manner of a glucoside, and this will explain the difference seen in autolysis. The nitrogen-free "transport sugar" of blood globulin (Langstein) is also probably combined as in a glucoside.

W. D. H.

**Utilisation of Proteids without the Intervention of Digestion.** LAFAYETTE B. MENDEL and ELBERT W. ROCKWOOD (*Amer. J. Physiol.*, 1904, 12, 336—352).—Recent research tends to show that during digestion proteolysis is more profound than was formerly considered to be the case, and that the tissue proteids are reconstructed from the simple decomposition products. Experiments were therefore undertaken to study the fate of proteids introduced directly into the blood stream or into the peritoneal cavity. Edestin (from hemp seed) and excelsin (from Brazil nuts) were introduced slowly, and were apparently retained for the most part. At any rate, they were not discovered in the urine or bile. Rapid injection causes toxic symptoms, especially inhibition of heart and respiration. The urine contained a proteose-like substance after injection of excelsin, but not of edestin. If edestin or casein is introduced into a loop of intestine from which digestion processes are excluded, they are not absorbed, but their proteoses and peptones rapidly disappear.

W. D. H.

**Inanition Studies. III. In Libella. IV. In Bees.** B. SLOWTZOFF (*Beitr. Chem. physiol. Path.*, 1904, 3, 163—169, 170—174).—A continuation of the author's work on inanition on the lines of his previous researches.

W. D. H.

**Further Proof of Ionic Action in Physiological Processes.** C. HUGH NEILSON and ORVILLE H. BROWN (*Amer. J. Physiol.*, 1904, 12, 374—386).—Non-electrolytes have no effect, except in solutions of 1 mol. concentration or more, on the decomposition of hydrogen per-

oxide by platinum black or by an aqueous extract of kidney; in concentrations greater than 1 mol., there is an inhibitory effect, which increases with the concentration. A salt in dilute concentration exerts either a depressing or stimulating effect, the former depending on the positive, the latter on the negative ion. W. D. H.

**Action of Salts on Muscle and Nerve.** ERNST OVERTON (*Pflüger's Archiv*, 1904, 105, 176—290).—The experiments were mainly made with thin muscles, like the frog's sartorius. Solutions of potassium chloride isotonic with blood kill the muscles in a few minutes and cause them to increase in weight. In a mixed solution of the chlorides of sodium and potassium, the muscle remains almost impermeable to potassium chloride until it is injured by that salt. Other potassium haloids and potassium nitrate behave in the same way. Loss of indirect excitability occurs rapidly when quite a small percentage (0.06 to 0.07) of potassium chloride is added to a sodium chloride solution; this effect is removed by the addition of calcium chloride or by placing the preparation in Ringer's solution (confirmatory of Locke). The harmful action attributed to potassium ions is like that caused by curare. Rubidium, caesium, and ammonium salts act like potassium, with some differences of detail which are fully described. Strontium acts like calcium as an antagonist to these, but barium and magnesium salts do not. It cannot, therefore, as Loeb supposes, be a simple question of valency of ions. W. D. H.

**Biological Importance of Iron.** ALESSANDRO BALDONI (*Chem. Centr.*, 1904, ii, 1476; from *Arch. exp. Path. Pharm.*, 52, 61—68).—Iron in nutriment is not only of importance in hæmoglobin formation, for all the tissues contain iron. The blood-free epidermis, the crystalline lens, the tissues of the crayfish, and, among plants, Iceland moss were investigated, and all were found to contain small amounts of iron. W. D. H.

**Influence of Local Temperature on Glycolysis in the Capillaries.** RAPHAEL LÉPINE and BOULUD (*Compt. rend.*, 1904, 139, 622—625).—After section of the sciatic nerves in dogs, one leg was immersed in cold water, the other in warm water. Ten minutes later, blood was withdrawn from the carotid artery and both crural veins. The venous blood contained less sugar than the arterial, but the loss was greatest in the venous blood of the cooled limb. Exceptions to the rule were noticed, but the total number of experiments performed is not recorded. If the blood is collected and kept, glycolysis occurs most rapidly in the blood where it occurred most rapidly *in vivo*. W. D. H.

**Formation of Aromatic Fatty Acids in the Animal Body.** FRANZ KNOOP (*Beitr. chem. Physiol. Path.*, 1904, 6, 150—162).—A study of the metabolism of fatty compounds in especial relationship to the origin in the body of those containing an aromatic nucleus. A large number were administered to animals; some were excreted un-

changed, others were oxidised in various ways, whilst in others the amino-group was removed.

W. D. H.

**Production of Choline from Lecithin and Brain Tissue.** ISIDOR H. CORIAT (*Amer. J. Physiol.*, 1904, 12, 353—364).—In view of the work of Mott and Halliburton on the importance of recognising choline as a sign of breakdown of nervous tissues, the theory is advanced that the splitting off of choline from lecithin is due to ferment action, but attempts to isolate the enzyme were unsuccessful. The enzyme is destroyed by heating, and acts best in slightly alkaline media. It comes into play during autolysis, but the yield of choline is small. During putrefaction, the yield is larger. Pepsin and trypsin fail to act on the lecithin of brain tissue, and inhibit autolysis. Lipase, however, is capable of splitting lecithin. Of the methods tried, heating lecithin with barium hydroxide was the only one which led to a theoretical yield of choline.

W. D. H.

**Receptivity of Cells in Normal and Immunised Animals.** MARTIN JACOBY (*Beitr. chem. Physiol. Path.*, 1904, 6, 113—131).—A contribution to the study of immunity in its various stages, with theoretical deduction on its mechanism. Some of the more important results are as follows: the receptor groups in the blood corpuscles for ricin are fixed there firmly, and cannot be removed by washing, by great pressure, or by digestive ferments. After blood corpuscles are treated with eel serum, the toxicity of the latter poison is diminished; in some cases it is increased: this is explained by the presence of a mixture of toxoids and toxins, the former being taken up by the corpuscles first. At 0°, rabbits' corpuscles are only agglutinated by eel serum; at 35°, they are completely hæmolyzed. Varieties of corpuscles which are not very susceptible to a toxin have their susceptibility increased during the progress of immunisation.

W. D. H.

**The Individuality of Trypsin.** LEO POLLAK (*Beitr. chem. Physiol. Path.*, 1904, 6, 95—112).—That trypsin is not a single substance has been stated by Vernon and others. It is regarded as possible that the pancreatic enzyme really consists of a number of specific ferments each acting on different proteids. In support of this, it is shown that treatment of a pancreatic extract with acid destroys its power of digesting serum, egg-white, and fibrin, but not of digesting gelatin. The latter property is therefore ascribed to a specific ferment, *glutininase*. Attempts by fractional methods to obtain a ferment acting only on serum proteids were unsuccessful, but led to the discovery of an *anti-glutininase*. This is not dialysable, but is not a ferment, not being destroyed by boiling. It is not identical with the anti-trypsin of blood serum.

W. D. H.

**Hæmolysinogenic and Agglutininogenic Action of Laked Corpuscles.** GEORGE N. STEWART (*Amer. J. Physiol.*, 1904, 12, 363—373).—Further experiments in support of the author's earlier conclusion that the stromata and liquid of water-laked corpuscles cause the production of sera with specific hæmolytic and agglutinating power.



The latter is the more marked effect, as is also the case with the serum obtained after the injection of stromata laked by freezing and thawing. Filtration through porous earthenware removes the agglutininogens and hæmolysinogens from the liquid of corpuscles laked by freezing and thawing and by foreign serum.

W. D. H.

**Action of Radium Emanations on Chymosin.** SIGVAL SCHMIDT-NIELSEN (*Beitr. chem. Physiol. Path.*, 1904, 6, 175—176).—Even long exposure to radium emanations causes no marked deterioration in the activity of chymosin (rennin).

W. D. H.

**Anti-substances against Croton in the Normal Organism.** FRANZ ALEXANDER LUST (*Beitr. chem. Physiol. Path.*, 1904, 6, 132—149).—The anti-substance found in the pig's gastric mucous membrane is resistant to heat, and is active in neutral, weakly acid, or weakly alkaline media. It is precipitable by alcohol or ether, or by saturation with ammonium sulphate. It is not dialysable and is not destroyed by artificial gastric digestion. It does not give the biuret reaction or any reaction with iodine-potassium iodide solution. It is not present in other organs, except in small quantities in those like the lungs and liver, which are rich in blood. Various animals differ a good deal in their susceptibility to croton.

W. D. H.

**Urinary Indoxyl.** LÉON GRIMBERT (*J. Pharm. Chim.*, 1904, [vi], 20, 398—407).—Human urine always contains indoxyl; its presence is not pathological; the amount varies with food, work, fatigue, and intestinal disorders. Even large quantities have no necessary importance; there is no ground for supposing it to be due to liver disease. Scatoxyl pigments do not occur in the urine, for by oxidation in the body scatole loses its methyl group and is converted into indoxyl. Red colours attributed to scatoxyl are produced by indirubin.

W. D. H.

**Studies in Diuresis. X. The Situation in the Kidney where Foreign Substances are Excreted.** JOH. BIBERFELD (*Pflüger's Archiv*, 1904, 105, 308—320).—The experiments were made with pigments, especially Berlin-blue, and they lead to the conclusion that this substance is excreted by the convoluted tubules. This work confirms in the main von Soberieranski's recent researches with indigo-carmin; a few points of difference are discussed. Some of the observations throw doubt on Ludwig's doctrine of reabsorption of water in the tubules.

W. D. H.

**A Case of Leucæmia.** F. PARKES WEBER (*Trans. Pathol. Soc. London*, 1904, 55, 288—296).—A case is described in which some resemblances to pernicious anæmia are noted; but there was no abnormal amount of urinary pigment, and no reaction for "free iron" in spleen, liver, and kidneys. There was great hyperplasia of the spleen and prevertebral hæmolymp glands, but not of the lymphatic glands proper. The bone marrow was abnormally firm, and contained excess of connective tissue.

W. D. H.

**Pseudo-lipæmia.** JOHN FAWCETT and A. E. BOYCOTT (*Trans. Pathol. Soc. London*, 1904, 55, 332—336).—In a fatal case of sarcoma of the pancreas, the blood-plasma was creamy, but prolonged centrifugalisation produced hardly any change. The creamy appearance is due to extremely minute particles of irregular shape, which are insoluble in ether or in 1 per cent. acetic acid. They are stained blue by Jenner's stain, but give no reaction for fat with osmic acid or Soudan III. The amount of fat in the blood was only 0.38 per cent., a number which comes within normal limits. The blood corpuscles showed nothing noteworthy. The creamy appearance is attributed, as in some cases recorded by others, to proteid material. W. D. H.

**The Action of Alcohols on Echinoderm Eggs.** HERMANN FÜHNER (*Chem. Centr.*, 1904, ii, 1517—1518; from *Arch. exp. Path. Pharm.*, 52, 69—82).—A large series of alcohols was investigated, and the general conclusion drawn that each successive member of a series is more toxic towards the eggs than the preceding. The secondary alcohols are less active. Urethane is about twice as poisonous as *n*-propyl alcohol, and about the same as *n*-butyl alcohol. Chloral hydrate approaches octyl alcohol in toxicity, and is 90 times more poisonous than urethane. Urea has no action. Glycerol, mannitol, and sucrose cause greater harm than can be explained by osmotic phenomena. Mixtures of alcohol with colloids, multivalent alcohols with urea and with sugar, are more toxic than the alcohols alone. Injurious effects in the more advanced larvæ are also described. W. D. H.

**The Action of Cobalt, Rhodium, and Chromium-ammonium Compounds on the Animal Organism.** JOHANNES BOCK (*Chem. Centr.*, 1904, ii, 1515—1517; from *Arch. exp. Path. Pharm.*, 52, 1—29, 30—38).—Hexamminecobalt chloride is strongly toxic, its most marked action being like that of curare. Aquopentamminecobalt sulphate acts similarly, but is not so toxic. Diaquotetramminecobalt sulphate is 100 times less poisonous. A number of other similar compounds were also investigated. A comparison of the lethal doses in frogs and mammals shows that the amount of cobalt present makes no difference, but the toxic action depends on the number of ammonium and  $H_2O$  groups, and on the nature of the acid residues in the complex radicles. The corresponding compounds of rhodium and chromium gave analogous results.

Non-toxic doses of hexamminecobalt chloride cause in frogs fascicular clonic contractions, which are due to excitation of motor nerve bundles. W. D. H.

**Toxicity of Amylene  $\alpha\beta$ -Chlorohydrin.** L. LAUNOY (*Compt. rend.*, 1904, 139, 650—652. Compare *Abstr.*, 1904, ii, 501).—The toxic action of this substance was tested on the dog, rabbit, mouse, guinea-pig, fowl, and pigeon. The above order is that of decreasing receptivity; that is, the animal most easily killed is placed first. *In vitro*, amylene chlorohydrin has a globulicidal action, which is not exercised *in vivo*. W. D. H.

**Toxins and Antitoxins. Diphtheria Poison.** SVANTE ARRHENIUS and THORVALD MADSEN (*Chem. Centr.*, 1904, ii, 1420; from *Bull. acad. roy. Danemark*, 1904, No. 4).—This contribution to immunity is largely polemical against Ehrlich. No foundation is discovered for the existence of prototoxoids or toxones. The dissociation constant varies but little. The diphtheria toxin is regarded as a homogeneous substance, and behaves like a unimolecular material. The loss of activity it undergoes is attributed to its gradual conversion into an atoxic substance or toxoid. The toxin and its toxoid react in equivalent quantities with the same amount of antitoxin, both products called *toxinan* and *toxoidan* respectively being non-poisonous.

W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Epidemic or Bacillary Dysentery.** R. H. FIRTH (*Trans. Pathol. Soc. London*, 1904, 55, 340—375).—Two types of bacilli are obtainable from dysenteric excreta: one, non-pathogenic, is able to decompose maltose, galactose, and mannitol with the formation of acid, but not of gas, and also able to produce indole; the other, which is pathogenic and to which the term *Bacillus dysenteriae* should be restricted, does not possess these characters. The former may be a degraded or transitional form of the latter, but this is uncertain, as also is their relationship, if any, to the bacilli of enteric fever. The prospects of establishing an acquired immunity against bacillary dysentery are not encouraging; experiments on rabbits and guinea-pigs show that passive immunity is brief, although active immunity is of longer duration.

W. D. H.

**Development of Organic Matter in Seeds during Maturation.** GUSTAV ANDRÉ (*Compt. rend.*, 1904, 139, 805—807).—In the maturation of lupin and haricot seeds, the percentage amount of ash was always greater at the commencement than at the end. The same was observed as regards total nitrogen except in the case of lupins. The non-nitrogenous organic matter is at first in the form of soluble carbohydrates.

N. H. J. M.

**Desiccation of Plants and Vegetable Tissues. Period of Maturation not Reversible. Final Equilibrium in Average Atmospheric Conditions.** MARCELLIN BERTHELOT (*Compt. rend.*, 1904, 139, 693—702).—The water retained by plants at the ordinary temperature, under given conditions of temperature and atmospheric moisture, corresponds with an equilibrium or limit. This limit varies much less for a given interval than the temperature of the air or the vapour tension of the air, provided that extremes are avoided.

N. H. J. M.



**Absolute Desiccation of Plants and Vegetable Substances : Period of Artificial Desiccation. Reversibility by Atmospheric Moisture.** MARCELLIN BERTHELOT (*Compt. rend.*, 1904, 139, 702—716).—The results of experiments with different plants established the reversibility between evaporation, in perfectly dry air, of the water retained in ordinary air and the absorption of aqueous vapour in ordinary air by plants dried by heating at  $110^{\circ}$ . The amount of water fixed by a dried plant is generally less than the amount necessary to a live plant. The reciprocity is therefore independent of vital action. N. H. J. M.

**Desiccation of Plants. Period of Vitality. Humectation by Liquid Water. Reversibility Imperfect.** MARCELLIN BERTHELOT (*Compt. rend.*, 1904, 139, 761—773).—Experiments on the absorption and exhalation of water by plants are described. N. H. J. M.

**Importance of Calcium and Magnesium Salts for Plants.** FR. GÖSSEL (*Chem. Centr.*, 1904, ii, 1157; from *Verh. Ges. Deut. Nf. Aerzte*, 1903, ii, 101—104).—The results of water- and soil-culture experiments failed to confirm Loew's theory that there must be a certain relation of  $\text{CaO} : \text{MgO}$ . In water cultures, the highest yields of barley and beans were obtained when  $\text{CaO} : \text{MgO} = 0.4 : 1$ , instead of  $1 : 1$  for barley and  $3 : 1$  for beans as Loew states. The conclusion is drawn that a definite relation between the two bases is unnecessary, and that the effect of lime depends especially on the character of the soil. N. H. J. M.

**Organic Compounds of Metals in Plants.** CHARLES F. SCHLAGDENHAUFFEN and E. REEB (*Compt. rend.*, 1904, 139, 980—983).—The residue obtained after incinerating the light petroleum extract of ripe barley consists of phosphoric acid and the phosphates of sodium, calcium, manganese, and iron, which existed in the plant as the distearyl glycerophosphate of neurine and the metallic derivatives of other lecithins respectively (compare *Abstr.*, 1902, ii, 625). The residue, similarly obtained from oats, rye, and wheat, contained potassium instead of sodium. M. A. W.

**Evolution of the Weight and the Organic Matters of Leaves during Necrobiosis in White Light.** L. BEULAYGUE (*Compt. rend.*, 1904, 139, 814—816).—Analyses are given of leaves of *Bougainvillea spectabilis* which had been dried at  $110^{\circ}$  immediately after being detached, and of similar leaves allowed to die gradually in boxes of colourless, red, yellow, green, and blue glass. These analyses were first made on the second day and again at intervals of two days. The leaves were well mixed every day. In the present paper, the results obtained with colourless glass are discussed.

The total carbohydrates (in 100 leaves) diminished gradually from 2.566 grams on the second day to 2.400 grams on the twelfth. The sugar diminished slightly to the sixth day, then slightly increased. The non-digestible proteid nitrogen and the nitrogen as nuclein increased regularly from 0.195 to 0.287 gram and from 0.182 to 0.273

gram respectively. The nitrogen as amides was almost exactly the same on the twelfth day as on the second day, but somewhat irregular results were obtained on the intermediate days. The results relating to total and to digestible proteids also show irregularities.

N. H. J. M.

**Non-proteid Nitrogenous Constituents of Agricultural Plants.** ERNST SCHULZE (*J. Landw.*, 1904, 52, 305—336).—The amount of non-proteid in seeds varies considerably; it is highest in leguminous and lowest in cereal and oily seeds. Choline was found in all the seeds examined; betaine was found in vetches, sunflower, and wheat; trigonelline in peas, hemp, and oats.

Etiolated seedlings contain either asparagine or glutamine; if both occur in the same plant, the amount of the one greatly predominates over that of the other. Leguminous seedlings, cereals and grasses, and poppy contain asparagine, whilst glutamine is found in pumpkins, ricinus, sunflower, white mustard, rape, cress, and radish, &c. Glutamine is, however, much less abundant than asparagine, the maximum amount in these plants being 2.5 per cent. in the dry matter. More than 25 per cent. of asparagine is sometimes found. Etiolated plants also contain the hexone bases, aminovaleric acid, leucine, phenylalanine, and tyrosine. Nuclein bases occur only in small amounts.

Roots and tubers resemble etiolated seedlings as regards their nitrogenous constituents. Asparagine or glutamine is nearly always the most abundant amide. Asparagine occurs in potatoes, glutamine in sugar beet and mangolds. Tyrosine was obtained from potatoes and mangolds, leucine, arginine, lysine, and histidine from potatoes. Sugar beet contains, besides glutamine, asparagine, leucine, tyrosine, betaine, arginine, guanidine, nuclein-bases, carnine, allantoin, choline, vernin, and ricine. The green parts of plants contain a considerable number of amides, but the amount actually separated was small.

As regards food value, it is probable that amides are more like proteids than carbohydrates, as stated by Lehmann. N. H. J. M.

**Milk of *Castilloa Elastica*.** ANNE W. K. DE JONG (*Ber.*, 1904, 37, 4398—4399. Compare *Abstr.*, 1904, ii, 762, 763).—The following were detected in the juice of *Castilloa elastica*: proteids, tannic acid, an acid,  $(C_{17}H_{30}O_{10})_x$ , potassium chloride, a sugar, and a substance, the neutral solution of which assumed a green colour on exposure to the atmosphere. A. McK.

**Chemistry of Celery (*Apium Graveolens*).** MAX BAMBERGER and ANTON LANDSIEDL (*Monatsh.*, 1904, 25, 1030—1034).—The aqueous extract of freshly-cut celery roots is found to contain asparagine, tyrosine, and mannitol. G. Y.

**Composition of Orange Juice.** K. FARNSTEINER and W. STÜBER (*Zeit. Nahr. Genussm.*, 1904, 8, 603—605).—The juices to which the following results refer were obtained from the various oranges after

the peel, spongy tissue, and seed had been removed. The expressed juice only came into contact with wooden vessels.

Grams per 100 c.c.	From oranges of unknown origin.		From	From
	Fresh.	Fermented.	Valencia oranges.	Messina oranges.
Specific gravity at 15° .....	1·0429	1·0084	1·0464	1·0451
"    "    after boiling	1·0454	1·0159	1·0466	1·0455
Total solids, dried 2½ hours at 100° .....	10·73	3·55	10·92	10·85
Citric acid (anhydrous) .....	1·19	1·25	1·79	1·47
Total sugars (as invert sugar)	8·26	0·38	7·65	7·86
Mineral matters (ash) .....	0·41	0·42	0·52	0·50
Alkalinity of ash (c.c. N/1 acid) .....	5·40	5·62	7·20	6·40
Nitrogen .....	0·064	0·053	0·099	0·075
Phosphoric acid .....	—	0·026	0·027	0·042
Glycerol .....	0·38	0·61	0·34	0·28
Alcohol .....	1·44*	4·29	—	—
Polarisation in 200 mm. tube, direct .....	—	—	- 0·11°	+ 2·45°
Polarisation in 200 mm. tube after inversion .....	—	—	- 3·16°	- 3·66°

W. P. S.

**The Formation of Formaldehyde in the Combustion of Tobacco.** AUGUSTE TRILLAT (*Compt. rend.*, 1904, 139, 742—744. Compare Abstr., 1904, i, 713).—Tobaccos from various sources were burnt in the form of cigars, cigarettes, or in clay or wooden pipes, and the formaldehyde in the products of combustion estimated as tetramethyldiaminodiphenylmethane, with the result that the quantity of formaldehyde formed varies little with the origin of the tobacco and amounts to 0·05 to 0·1 per cent. of the weight of the substance burnt; the yield was slightly higher in the case of the clay than of the wooden pipe, probably owing to surface catalytic action. The formaldehyde does not, however, exist in the free state in the products of combustion, but combines with the nitrogenous bases (such as nicotine) (compare Schindeimeister, Abstr., 1903, ii, 115) also present in the tobacco smoke to form compounds which possess none of the deleterious properties of the two constituents.

M. A. W.

**Treatment of Soil with Ether, Carbon Disulphide, Chloroform, Benzene, and Hydrogen Peroxide.** Effect on the Growth of Plants. FRIEDRICH NOBBE and L. RICHTER (*Landw. Versuchs-Stat.*, 1904, 60, 433—448).—Application of ether and hydrogen peroxide to soil in which peas were grown failed to sterilise it and were rather favourable to growth than unfavourable. Ether applied as an emulsion increased the produce 41·5 per cent.

\* A small quantity of an alcoholic solution of salicylic acid had been added to this juice.



Further experiments in which oats were grown in soil treated with ether, benzene, carbon disulphide, and chloroform showed that higher yields were obtained in every case than with untreated soil, and that larger amounts of nitrogen and total ash were assimilated. The action extended to second crops after the odour of the substances applied had disappeared.

It is shown that the soils underwent no change. The increased results would seem to be due to a directly stimulating action of the substances employed or of their products of decomposition.

N. H. J. M.

**Effect of Soil Sterilisation on Plant Development.** CARL SCHULZE (*Bied. Centr.*, 1904, 33, 748—751; from *Jahresb. Ver. Vertret. ang. Bot.*, 1904).—Experiments are described in which various plants were grown in normal and in sterilised arable and meadow soils. Sterilisation was effected by heating at 100° or at 125°. The different plants showed very different degrees of sensitiveness towards the decomposition products of the soil, and the results also varied according to the nature of the original soil, sterilised meadow soil being more injurious than sterilised arable soil. Mustard proved to be particularly sensitive, whilst oats grown in sterilised arable soil showed very slight signs of injury. Plants which were able to recover from the injury due to the heating of the soil were sometimes much more luxuriant than those grown in normal soil.

Sterilisation had least injurious effect on garden soil; oats grown in the sterilised soil showed no signs of injury and the yield was raised by 30—70 per cent. Similar results were obtained with mustard.

The injurious effect of sterilisation on meadow soil is almost entirely overcome by the application of calcium carbonate. The yield of mixed grasses was raised by more than 100 per cent. by sterilising and adding calcium carbonate.

N. H. J. M.

**Solubility of Soil Constituents.** FELIX MACH (*Chem. Centr.*, 1904, ii, 1164—1165; from *Verh. Ges. Deut. Ntf. Aerzte*, 1903, ii, 91—94).—Ferric, aluminium, and tricalcium phosphates were dissolved to some extent by water. Water containing hydrated silica only dissolved aluminium phosphate somewhat more than water alone. Water and humic acid dissolved two or three times as much, a saturated solution of carbon dioxide much less ferric and aluminium phosphates, but twice as much calcium phosphate as pure water.

Calcium and magnesium carbonates are about twice as soluble in water and silica as in water alone. The solubility of gypsum was about the same in all the solvents. Carbon dioxide somewhat increased the solubility of felspar and oligoclase and still more the solubility of the calcium of desmine and natrolite. In the case of muschelkalk and basalt, carbon dioxide increased the solubility of every constituent except sulphuric acid and silica.

N. H. J. M.

**Black Soils of Legienen, Rössel, in East Prussia.** EDWIN BLANCK (*Landw. Versuchs-Stat.*, 1904, 60, 407—418).—Complete chemical analyses and mechanical separations of several samples of

surface and subsoil are given. The black soils both of East and West Prussia contain much less humus than those of Russia.

N. H. J. M.

**Humic Acids of Grey Sand and Brown Sandstone.** ADOLF MAYER (*Landw. Versuchs-Stat.*, 1904, 60, 475—480).—The humic acids of brown sandstone contain less carbon than those of grey sand. It is probable that the humic acids of grey sand are oxidised when ferric oxide is present, and dissolve as ferrous salts of oxyhumic acids. These are oxidised in the subsoil to insoluble ferric salts.

N. H. J. M.

**Beet Molasses of Various Origin.** TH. DIETRICH and FELIX MACH (*Landw. Versuchs-Stat.*, 1904, 60, 347—357).—Analyses of twenty samples of molasses. The results include dry matter, ash, total sugar, invert sugar, total nitrogen, proteid nitrogen, nitric nitrogen, carbon dioxide, lime, and alkalinity or acidity.

N. H. J. M.

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## Analytical Chemistry.

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**Modified Gas-burettes.** JULIUS ZRZAWY (*Chem. Zeit.*, 1904, 28, 1172).—Hempel burettes so constructed that it is possible to read the volume of gas to 0.01 c.c.

L. DE K.

**A New Burette for Testing Normal Solutions.** A. HESSE (*Chem. Zeit.*, 1904, 28, 1172).—The burette is fitted with a beaker-shaped cup. The first 0.5 c.c. and the last 49—51 c.c. are divided to 1/100 c.c., the tube being drawn out at these places; the remainder is divided as usual to 1/10 c.c. The parts drawn out are not calibrated. It is merely intended for checking normal solutions.

L. DE K.

**Determination of the Neutralisation Point by Conductivity Measurement.** II. FRIEDRICH W. KÜSTER, MAX GRÜTERS, and W. GEIBEL (*Zeit. anorg. Chem.*, 1904, 42, 225—234. Compare Abstr., 1903, ii, 611).—Ten c.c. of  $N/10$  sulphuric acid were diluted with 500 c.c. of water and then  $N/10$  sodium hydroxide gradually added, the conductivity of the solution being measured after the addition of each c.c. of alkali. The conductivity of the sulphuric acid falls regularly as the neutralisation proceeds until a minimum value is attained exactly at the neutralisation point; an increase in the value occurs when more sodium hydroxide is added. By this method, the end-point may be determined much more sharply than by the use of any indicator.

Phosphoric acid behaves as a monobasic acid; the break of the conductivity curve coincides with the results obtained by titrating phosphoric acid with methyl-orange as indicator.

In order to show how the method may be applied when indicators fail, 20 c.c. of *N*/10 potassium dichromate were mixed with 10 c.c. *N*/10 sulphuric acid and then titrated with *N*/10 sodium hydroxide by conductivity measurement as before; the sulphuric acid present can be titrated as sharply as if the dichromate were absent. Similar measurements were made with potassium permanganate in the solution instead of potassium dichromate.

The presence of precipitates also does not impair the accuracy of the method, thus citric acid may be titrated by barium hydroxide.

When weak organic acids were titrated by the gradual addition of sodium hydroxide, the minimum of conductivity was attained too soon; the method yields correct results, however, when the acid is added to the alkali. Acetic, lactic, tartaric, and citric acids were titrated in this manner.

Determinations of the amount of acetic acid in a strongly coloured vinegar examined are quoted. The total acid in a specimen of red wine was also determined.

Magnesia and various alkaloids were similarly titrated.

A. McK.

**The Theory of Indicators and its Bearing on the Analysis of Physiological Solutions by means of Volumetric Methods.** GEORGE H. A. CLOWES (*Amer. J. Pharm.*, 1904, 76, 453—467, 511—525).—This paper has for its object the outlining of the nature of the various classes of indicators used in acidimetry and alkalimetry, studying their behaviour towards various weak bases and acids which may occur in the course of physiological work; further, to make a series of tests on artificial and normal stomach contents, pancreatic fluids, blood serum, &c. With regard to the behaviour of amino-acids, asparagine, glycine, leucine, tyrosine, and aspartic acid towards indicators, experiments were made in which their action was compared with that of the ammonium salts of formic, acetic, and lactic acids, acetamide, formamide, and urea. Poirrier's blue was found to be sensitive to all the free acid groups, and entirely indifferent to ammonia and amino-groups. Phenolphthalein is less sensitive to acid groups and far more sensitive to ammonia than Poirrier's blue. Alizarin is sensitive to both ammonia and strong acid groups, but is indifferent to the weak acid groups in asparagine, tyrosine, &c., and also to the amino-group of these compounds.

Phloroglucivanillin is entirely indifferent to all weak organic acids. This indicator is of great value in differentiating the weak bases, being sensitive not only to ammonia, but also to the amino-group in asparagine, glycine, leucine, and tyrosine, and indifferent to the amino-groups present in acetamide, formamide, and urea. From the experiments with proteids, &c., it seems possible that some sort of relationship obtains between the various nitrogen-containing groups in the proteid and the end-points of different indicators. The comparison of volumetric with gravimetric analyses of normal and pathological stomach contents showed that, provided a purely proteid test meal was employed, the phenolphthalein end-point indicates fairly accurately the total available hydrochloric acid present, both free and



combined more or less feebly with proteids. The actual free acid is given by phloroglucivanillin. After allowing for the influence of phosphates and traces of organic acids, the range of titration between the end-point of phloroglucivanillin and that of phenolphthalein may be said to be a function of the basic affinities of the proteids and their decomposition products present. Under conditions where peptic digestion fails to take its normal course, the above rules are no longer applicable. In tryptic digestion, the range of titration, after allowing for the influence of carbon dioxide, is at first more or less proportionate to the amount of proteid brought into solution, but subsequently increases in undue proportion to the total nitrogen as the digestion proceeds. The wide variation between the end-points of phenolphthalein, alizarin, and phloroglucivanillin in estimating the alkalinity of blood serum emphasises the necessity of certain uniform standards for this purpose. With regard to urine, the titration results are fairly dependent on the amount of phosphates present. In the presence of any considerable quantity of ammonia, which exerts a more powerful effect on alizarin and phenolphthalein than urea, the urine will be less acid or even alkaline to phenolphthalein, and more strongly alkaline to alizarin than is normally the case.

W. P. S.

**Standardisation of Normal Solutions.** MAX SCHOLTZ (*Arch. Pharm.*, 1904, 242, 575—578).—Of an approximately 0.01*N* sodium hydroxide solution, 10 c.c. required the following volumes, I, of an approximately 0.01*N* hydrochloric acid; and of the same acid, 10 c.c. required the following amounts, II, of the same alkali; according to the indicator employed:

	Phenol- phthalein.	Litmus.	Rosolic acid.	<i>p</i> -Nitro- phenol.	Iodoeosin.	Methyl- orange.
I.	9.68	9.83	9.87	10.00	9.80	10.70 c.c.
II.	10.08	9.92	9.92	9.99	9.68	9.28 „

When standard solutions as weak as these are being used, it is evidently important that the indicator and the direction of the change of colour in the standardisation should be the same as are employed in the actual estimation.

The results are discussed from the point of view of the theory of electrolytic dissociation (compare *Abstr.*, 1904, ii, 771). C. F. B.

**Potassium Bromide as Indicator when using Fehling's Solution.** PIO BERTI (*Chem. Centr.*, 1904, ii, 1433; from *Bull. Assoc. Chim. Sucr. et Dist.*, 21, 1234—1236).—A drop of the liquid is put on to a double piece of filter paper resting on a porcelain plate, and, after removing the paper, the moist spot is touched with a particle of potassium bromide and a drop of sulphuric acid. If there should still be a trace of dissolved copper, a violet colour is noticed owing to the formation of cuprous bromide.

L. DE K.

**Apparatus for Extracting Liquids with Chloroform.** ERICH BAUM (*Chem. Zeit.*, 1904, 28, 1172).—A modification of the van Rijn

apparatus (Abstr., 1896, ii, 17), which consists in fixing the overflow tube (siphon) in the lower part of the extractor, thus allowing the use of solvents heavier than water.

L. DE K.

**New Extractor.** ANDREA SANNA (*Gazzetta*, 1904, 34, ii, 224—228).—This extractor consists of a flask fixed obliquely and filled about half-full with the substance to be extracted and the solvent. Through the double-bored stopper of the flask pass the bent inner-tube of an inverted condenser and a short glass tube furnished with a cock and an india-rubber tube. The upper end of the condenser tube is also bent and passes into an Erlenmeyer flask, through the stopper of which passes also a short glass tube with a cock. The latter is left open during the heating of the substance with the solvent. When the extraction is complete, the condenser and Erlenmeyer flask are turned round so that the end of the bent condenser tube is now at the lowest part of the round flask, whilst the Erlenmeyer flask is at a still lower level. The cock attached to the round flask is then opened and the solution forced through the condenser tube into the Erlenmeyer flask. The apparatus is then inclined so that the round flask is lower than the Erlenmeyer and the solvent distilled off from the latter into the round flask, the cock attached to the Erlenmeyer flask being meanwhile kept closed. The extracted material then remains in the Erlenmeyer flask. These operations may be repeated until the extraction is complete.

The apparatus gives good results for the extraction of liquids or solids, as, for example, in the determination of fat in cheese, butter, &c., and it acts more quickly than a Soxhlet or Garralowschy extractor. In determining fat in a material like cheese, it is advisable to pack the substance in filter paper tied up with cotton, as this prevents solid particles from being carried away.

T. H. P.

**Palladium-Hydrogen as a Reducing Agent in Quantitative Analysis.** ALFRED C. CHAPMAN (*Analyst*, 1904, 29, 346—357).—In an investigation undertaken for the purpose of ascertaining to what extent palladium-hydrogen could be employed as a quantitative reducing agent, it was found that ferric salts, as well as potassium ferricyanide, were completely and readily reduced. Chromates in acid solutions were reduced to chromic salts. The palladium was employed in the form of foil of such thickness that a piece 2 inches square weighed about 8 grams. A piece of thick palladium wire was welded to this, and the foil was charged by being made the negative electrode in an ordinary cell containing dilute sulphuric acid, the current being obtained from the main or from accumulators. The charged metal was, after washing, suspended in the boiling solution under examination. In the case of cupric, stannic, arsenic, manganic, vanadic, and molybdic compounds, the reduction was either incomplete or imperfect. Potassium chlorate was only partly reduced, whilst bromates and iodates were not attacked. Ceric salts were reduced to cerous salts, which latter could be titrated with ferrous ammonium sulphate solution, as the lower oxide was itself capable of oxidising the ferrous solution.

W. P. S.

**Action of Hydrochloric Acid on Potassium Chlorate.** A. KOLB and E. DAVIDSON (*Zeit. angew. Chem.*, 1904, 17, 1883—1887).—During the action of hydrochloric acid on potassium chlorate in the presence of potassium iodide, atmospheric oxygen, and especially the oxygen in solution, causes oxidation of the hydriodic acid formed, and the iodine thus liberated accelerates the action. The error thus caused in the estimation of chlorate may be obviated by conducting the operation in the absence of oxygen. The reaction between hydrochloric acid and potassium chlorate proceeds at the ordinary temperature only in the presence of a considerable excess of hydrochloric acid and is quickly completed; chlorates may be estimated in this way. The substitution of cadmium iodide for potassium iodide has no special advantage, whilst aluminium iodide and mercuric iodide are unsuitable. An acceleration of the reaction was not observed when antimony chloride or cerium sulphate was present. The action is retarded by the addition of water. A. McK.

**Estimation of Iodine in Soluble Iodides, also in the presence of Bromides and Chlorides.** HUGO DITZ and BENJAMIN M. MARGOSCHES (*Chem. Zeit.*, 1902, 28, 1191—1194).—The solution containing the iodide is mixed with a sufficiency of potassium iodate and then with a slight excess of dilute sulphuric acid. The liberated iodine is extracted with toluene and finally titrated with sodium thio-sulphate. If a known amount of iodate has been added, the excess of this may be estimated in the aqueous liquid by adding potassium iodide and dilute sulphuric acid and titrating with sodium thiosulphate. The shaking with toluene may even be omitted and the iodine expelled by distillation, when the distillate, which is collected in a solution of potassium iodide, may be at once titrated; as, however, this renders the process somewhat tedious, it is more convenient to boil off the iodine and titrate the residual iodate.

If bromides or chlorides are present, the same process applies if the iodine is estimated in its toluene solution and not indirectly in the aqueous liquid. If the excess of iodate is to be estimated in the aqueous liquid after shaking with toluene, acetic acid should be substituted for sulphuric acid. L. DE K.

**Estimation of Sulphur by Aid of Sodium Peroxide.** ALBERT NEUMANN and JOSEPH MEINERTZ (*Zeit. physiol. Chem.*, 1904, 43, 37—40. Compare Düring, *Abstr.*, 1897, ii, 63).—The substance is fused in a nickel crucible with a mixture of sodium and potassium carbonates and sodium peroxide. The peroxide should be added gradually in 3 or 4 distinct portions. It is found that a gas flame may be employed without causing error. J. J. S.

**Estimation of Sulphates in Vegetable Products.** GEORGE S. FRAPS (*Chem. Centr.*, 1904, ii, 1433; from *Rep. Chemist North Carolina Agric. Experim. Stat.*, 1902, 1903).—Five grams of the substance are treated for half an hour with 50 c.c. of 1 per cent. hydrochloric acid, and the residue is washed with the same acid until the filtrate measures



about 250 c.c. This is then heated to boiling and precipitated with barium chloride as usual. A number of results are communicated.

L. DE K.

**Apparatus for the Estimation of Nitrogen.** ÉMILE NICOLAS and DELAUD (*Bull. Soc. chim.*, 1904, [iii], 31, 1193—1194).—This apparatus is a slightly modified form of that described by Porcher and Brisac (*Abstr.*, 1903, ii, 179).

T. A. H.

**Sodium Peroxide in Organic Analysis.** FRITZ VON KONEK and ARTHUR ZÖHLIS (*Zeit. angew. Chem.*, 1904, 17, 1887. Compare *Abstr.*, 1904, ii, 775).—As much as 90 per cent. of the nitrogen in organic substances, which are difficult to burn and which are rich in nitrogen, may be converted into nitrate by means of sodium peroxide.

A. McK.

**Rapid Estimation of Nitrogen in Steel or Iron.** HJALMAR BRAUNE (*Chem. Centr.*, 1904, ii, 1167; from *Oesterr. Zeit. Berg. Hütt.*, 52, 491).—One gram of the sample is dissolved in 10 c.c. of ammonia-free hydrochloric acid of sp. gr. 1.124, and the filtered solution introduced into a distilling flask containing 250 c.c. of boiling water and 20 c.c. of an alkali hydroxide solution sufficiently strong to neutralise the acid. The distillate is then "Nesslerised" in the usual manner.

L. DE K.

**Estimation of Ammonia and Amides.** JEAN EFFRONT (*Ber.*, 1904, 37, 4290—4295).—The reaction between alkali hypochlorites and nitrogen compounds may be more accurately followed by determining the loss of active chlorine than by measuring the nitrogen evolved. Amines, imines, nitriles, amides, and amino-acids react with sodium hypochlorite, the active chlorine disappearing being proportional to the weight of organic compound added; tetra-alkylammonium compounds and betaine do not react. A detailed method of carrying out the determination is described.

Ammonia is completely oxidised by sodium hypochlorite at the ordinary temperature (compare Thiele, *Abstr.*, 1893, ii, 317), the nitrogen evolved containing a trace of nitrogen chloride. The ammonia in samples of water may be determined by this method to 0.2 milligram per litre. Proteids may also be determined in water after expelling free ammonia by boiling with sodium carbonate. Proteids show a constant reducing power towards hypochlorites, peptones also show a constant, but lower, reducing power.

C. H. D.

**Estimation of Ammonia in Vegetable Products, Beets, &c.** EUGÈNE SELIER (*Chem. Centr.*, 1904, ii, 1433—1434; from *Bull. Assoc. Chim. Sucr. Dist.*, 21, 1223—1232).—Ammonia may be completely expelled from beetroot juice by the author's magnesia process (*Abstr.*, 1903, ii, 329). In the presence of oxamide, the distillation with magnesia should take place below 40°. Liquids containing urea should be distilled below 80°. Acid ammonium urate

should be treated for a short time with dilute hydrochloric acid and then distilled with magnesia at  $36-42^{\circ}$ . As hydrochloric acid, however, may hydrolyse urea, the author recommends distilling urine or sediments containing acid urates with calcium oxide at a moderate temperature. Methylamine, if present, partially passes over with the ammonia. If the products should happen to contain magnesium ammonium phosphate, they should be digested for some time with dilute acids; the ammonia will then be completely expelled by boiling with magnesia, but not at a lower temperature. L. DE K.

**Electrolytic Estimation of Nitric Acid with a Rotating Anode.** LESLIE HOWARD INGHAM (*J. Amer. Chem. Soc.*, 1904, 26, 1251—1255).—The author has tried a process suggested in 1890 by Vortmann (*Abstr.*, 1890, 1467) for the electrolytic estimation of nitric acid and obtained satisfactory results. The solution of the nitrate is mixed with a known volume of standard sulphuric acid, a definite amount of copper sulphate is added, and the mixture submitted to electrolysis. The ammonia formed by the reduction of the nitrate neutralises a portion of the acid, and from the amount of free acid left (which includes that of the copper sulphate) the amount of nitric acid is readily calculated.

The best conditions for a successful experiment were found to be 25 c.c. of copper sulphate solution ( $= 0.2533$  gram of copper), 0.5 gram of potassium nitrate, 25 c.c. of normal sulphuric acid; 9 volts, 4 amperes, time 30 minutes, speed of rotating anode, 1 [ $\approx$  about 230 revolutions per minute]. L. DE K.

**The Evolution of Hydrogen for Marsh's Arsenic Test.** CARL MAI and H. HURT (*Zeit. anal. Chem.*, 1904, 43, 557—559).—To accelerate the evolution of hydrogen from zinc and sulphuric acid, it is usual to add a small quantity of a salt of some electro-negative metal. Many of these, however, diminish the sensitiveness of the test, copper and platinum seeming to be the only unexceptionable agents. With the former, the evolution of gas is more regular than with the latter. Iron in any form must be most carefully avoided, since in its presence considerable quantities of arsenic may be overlooked. M. J. S.

**Detection of Arsenic in the Ashes of Cremated Bodies.** CARL MAI (*Zeit. anal. Chem.*, 1904, 43, 617—619).—On the occasion of the examination of the ashes of a cremated body, the larger bone fragments, after careful cleaning, were found to be absolutely free from arsenic, whilst the mixed pulverulent portion of the ash, in which iron was also present, was highly arsenical. Some iron nails and screws found in the urn also contained much arsenic, and it is assumed that the presence of that element in the miscellaneous powder was entirely due to the metals employed in the construction of the coffin. From a forensic point of view, it is advisable that neither metal nor pigments should be used in coffins intended for cremations. M. J. S.

**Improvement of Drown and Shimer's Method of Estimating Silicon in Irons.** J. THILL (*Zeit. anal. Chem.*, 1904, 43, 552—553).—If it is attempted to accelerate the tedious evaporation of the iron solution by substituting the direct heat of a lamp for that of the water-bath, there is danger of loss from bumping and spirting. The addition of ammonium chloride obviates this difficulty. The author's practice is as follows: a litre of concentrated sulphuric acid is mixed with an equal volume of water, and (after cooling) a litre of nitric acid of sp. gr. 1.4 and a solution of 240 grams of ammonium chloride in a litre of water are added. Of this reagent, 50—70 c.c. are used for dissolving 1—2 grams of iron. Solution and evaporation can then be carried on in a beaker over a Bunsen burner with interposed wire gauze, and an estimation completed within an hour. M. J. S.

**Qualitative Detection of Silica.** JULIUS PETERSEN (*Zeit. anal. Chem.*, 1904, 43, 619—623).—A modification of the method suggested by Daniel (*Abstr.*, 1904, ii, 289) permits the detection of 2.5 mg. of silica with certainty. In a small platinum crucible is placed a mixture of the substance (0.5 gram) with cryolite (0.25 gram), a few milligrams of magnesite, and some concentrated sulphuric acid. The crucible is lowered to the bottom of a test-tube, to which is then fitted a cork carrying a glass rod nearly reaching the crucible. The rod is flattened at its lower end, which is covered with asphalt varnish, and from it a drop of water hangs. The whole of the glass rod and the interior of the test-tube have first been coated with collodion containing 2 vols. per cent. of castor oil. This film protects the glass completely from the action of hydrofluoric acid. The bottom of the tube is then plunged into water of 60°. At this temperature, the formation of silicon fluoride is sufficiently rapid to give a white film on the surface of the drop of water in five minutes. M. J. S.

**Estimation and Separation of Calcium in presence of Phosphoric Acid.** K. K. JÄRVINEN (*Zeit. anal. Chem.*, 1904, 43, 559—562).—The estimation of calcium in presence of phosphoric acid is liable to two sources of error: incomplete precipitation of the lime and contamination of the precipitate with phosphoric acid. The following mode of operating gives fairly satisfactory results: the solution, which must be as free as possible from ammonium salts, is mixed with ammonia until calcium phosphate just begins to precipitate, and the precipitate is redissolved by a drop of hydrochloric acid. The liquid is heated to boiling and poured slowly into a mixture of equivalent quantities of ammonium oxalate and oxalic acid. Ammonia, not stronger than 1 per cent., is then added drop by drop until the mixture is alkaline and the estimation is finished in the usual manner. M. J. S.

**Estimation of Calcium Oxide in Burnt Lime. Solubility of Calcium Carbonate in Solutions of Ammonium Nitrate.** GEORG BERJ and WLADISLAW KOSINENKO (*Landw. Versuchs-Stat.*, 1904, 60, 419—425).—Bodenbender and Ihlee's method for determining calcium oxide in burnt lime (*Zeit. Rübenzuckerind.*, 1879) by boiling



with ammonium nitrate can give correct results only under certain conditions, owing to the varying amounts of calcium carbonate dissolved.

It is found that calcium carbonate is practically insoluble in  $N/5$  ammonium nitrate when the mixture of carbonate and oxide contains 8 per cent. or more of the latter. According to the amount of carbonate present (determined with a Scheibler apparatus), 3—5 grams of substance are treated with 1 litre of  $N/5$  ammonium nitrate in a rotatory apparatus turning about 40 times a minute. The calcium oxide is afterwards determined in the usual manner in an aliquot portion of the filtered or subsided solution.

N. H. J. M.

**Use of a Rotating Anode in the Electrolytic Estimation of Zinc.** LESLIE H. INGHAM (*J. Amer. Chem. Soc.*, 1904, 26, 1269—1283).—A lengthy investigation as to the best and quickest method of electrolytic zinc assay. The ore is oxidised with nitric acid and repeatedly evaporated with hydrochloric acid, and the iron is removed by a double precipitation with ammonia. The ammoniacal filtrate, after adding some more ammonium chloride, is then submitted to electrolysis, using a rotating anode; for working details, the original paper should be consulted. Good results are also obtained by the electrolysis of solutions containing sodium acetate or formate.

L. DE K.

**Volumetric Estimation of Lead.** GUIDO CERVI (*Chem. Centr.*, 1904, ii, 1343—1344; from *L'Industria Chimica*, 6, 289—290).—A slight modification of the process recommended by Guess (*Trans. Amer. Inst. Min. Eng.*, 1904).

The neutralised solution of the lead is acidified with acetic acid, sodium acetate is added, the solution is heated to boiling, and the lead precipitated with standard solution of potassium dichromate. When cold, the liquid is diluted to a definite volume and in an aliquot part of the filtrate, the excess of dichromate is estimated as usual by adding dilute sulphuric acid and potassium iodide and titrating the liberated iodine with standard sodium thiosulphate. In the presence of antimony or iron, the lead should be first separated as sulphate, which is then dissolved and titrated.

L. DE K.

**[Analysis of] Commercial Lead.** AUGUSTE HOLLARD and L. BERTIAUX (*Bull. Soc. chim.*, 1904, [iii], 31, 1124—1128. Compare Abstr., 1899, ii, 523).—Five grams of commercial lead are dissolved in 86 c.c. of nitric acid of 36° B. previously diluted with water. The liquid is made up to 300 c.c. and the lead removed as the peroxide, using a current of 0.2 ampere (compare Abstr., 1903, ii, 294). Five c.c. of sulphuric acid are then added to the lead-free liquid, and this is evaporated down until sulphuric acid fumes are copiously evolved; it is then diluted to 300 c.c. and the copper determined electrolytically, the precautions already indicated (Abstr., 1904, ii, 682) being taken to obtain a copper deposit free from arsenic, antimony, or bismuth. Nickel and zinc are separately estimated in the residual liquid by the process previously described (Abstr., 1903, ii, 335; 1904, ii, 92 and 682), and iron by titration with iodine (Abstr., 1904, ii, 368 and 592).

For the estimation of arsenic and antimony, a fresh portion of lead is treated with sulphuric acid, and the arsenic separated by distillation after the addition of ferrous sulphate and hydrochloric acid (Abstr., 1900, ii, 438). The residual liquid is placed in a flask having the bottom coated outside with fireclay, and to it is added zinc chloride solution of sp. gr. 2; the antimony chloride is distilled off in a current of hydrogen chloride and finally estimated electrolytically. From a hot nitric acid solution of the lead, silver is precipitated as the chloride, the latter is dissolved in potassium cyanide solution, and the metal determined electrolytically. Sulphur is precipitated as barium sulphate from a nitro-hydrochloric acid solution of the original material. Bismuth is separated as the basic nitrate, which is then converted into sulphide and freed from arsenic, antimony, and tin by means of ammonium hydrosulphide, and is finally estimated by electrolysis of a solution of the sulphate (Abstr., 1904, ii, 684). The tin obtained as the sulphide in the separation of the bismuth is freed from antimony by electrolysis in presence of potassium cyanide, and finally determined electrolytically in hydrochloric acid solution in presence of ammonium oxalate. A tabular statement showing the composition of thirteen samples of commercial lead is given in the original.

T. A. H.

#### Electrolytic Separations possible with a Rotating Anode.

DONALD S. ASHBROOK (*J. Amer. Chem. Soc.*, 1904, 26, 1283—1290).—A paper unsuitable for adequate abstraction. Working details are given as to the electrolytic separation of *copper* from aluminium, antimony, arsenic, cadmium, chromium, cobalt, iron, lead, magnesium, manganese, nickel, uranium and zinc; *cadmium* from aluminium, chromium, cobalt, iron, magnesium, manganese, nickel and zinc; *silver* from aluminium.

L. DE K.

**Electrolytic Estimation of Copper.** AUGUST KUFFERATH (*Zeit. angew. Chem.*, 1904, 17, 1785—1786).—About 1.5 grams of the substance containing copper are dissolved in dilute sulphuric acid with the aid of nitric acid; if an excess of the latter is carefully avoided, there is no need for evaporating to dryness. After diluting to about 130 c.c., 2 grams of formaldehyde are added, and the copper is deposited as usual by heating at 60—65° and using a current of 2.5—3 amperes and 2 volts. Without interrupting the current, the deposit is washed first with water, then with alcohol, and finally with ether, and is then dried in a vacuum over sulphuric acid and weighed. Iron, nickel, and cobalt are not deposited in the presence of formaldehyde.

L. DE K.

**Titration of Copper by Potassium Iodide, and Applicability of the Method in presence of Iron and Arsenic.** L. MOSER (*Zeit. anal. Chem.*, 1904, 43, 597—616).—Both the original method of De Haen and Rümpler and Low's modifications (Abstr., 1896, ii, 450) are affected by sources of error, and the variation suggested by Litterscheid (Abstr., 1902, ii, 531) is useless in presence of iron or

arsenic. The author has reinvestigated De Haen's method, employing thiosulphate for the titration of the iodine. When free acids are absent, the results are only satisfactory if the solutions are sufficiently concentrated, but in presence of free sulphuric acid correct results are obtained, even when the dilution and amount of free acid are largely varied. Hydrochloric and nitric acids as acidifying agents are inadmissible, but acetic acid may be used. Although the action of potassium iodide on a cupric salt indubitably consists at first in the formation of cupric iodide, in the presence of free acid the decomposition into cuprous iodide and free iodine is so rapid and complete that titration may be commenced two minutes after making the mixture; a delay of ten minutes does not materially affect the results, but after an hour higher numbers are obtained. The following is the form in which the process is recommended: the copper solution (50 c.c. containing about 0.15 gram of copper as sulphate) is placed in a 300 c.c. stoppered bottle; 5 c.c. of 10*N* sulphuric acid and 2 grams of solid potassium iodide are added and the bottle is shaken for two minutes. The free iodine is then titrated with *N*/10 thiosulphate, adding starch when near the end.

To render the method applicable in presence of iron and arsenic, the solution of the metals (as sulphates) is treated with an excess of sodium pyrophosphate sufficient to redissolve the precipitate at first formed. If the original solution contained free sulphuric acid, some sodium acetate is added, then 4—5 grams of potassium iodide and 5—10 c.c. of 80 per cent. acetic acid. In these circumstances, the copper alone liberates iodine, but to obtain good results it is advisable to avoid dilution as far as possible, wherefore solid sodium pyrophosphate should be used for the precipitation, and if the amount of iron exceeds that of copper by more than one-third, the quantity of potassium iodide should be increased; a somewhat longer time (15 minutes) is allowed before titrating, and the thiosulphate run in very slowly.

M. J. S.

**Detection and Estimation of Minute Quantities of Mercury.** CONSTANTIN ZENGELIS (*Zeit. anal. Chem.*, 1904, 43, 544—547).—For the detection of mercury in urine, the urine is feebly acidified with hydrochloric acid and left in contact for 12 hours with a spiral of copper and platinum wires. The spiral is then washed with dilute sodium hydroxide, water, alcohol, and ether, and dried completely over sulphuric acid. It is then thrust to the bottom of a narrow test-tube, the upper part of which is moistened with a solution of iodine in anhydrous ether. Holding the tube horizontally, the coil is heated, and the evolved mercury vapour is arrested by the ring of iodine solution and converted into mercuric iodide. Complete absence of water is indispensable: 0.2 milligram of mercury can be detected in 200—300 c.c. of urine. For quantitative estimation, the urine is boiled with an excess of sodium hydroxide and a little of a reducing sugar. The phosphate precipitate is dissolved in nitric acid and the solution electrolysed at 40—50° with a weighed piece of platinum foil as cathode.

M. J. S.



**Detection and Estimation of Traces of Mercury in Urine with the aid of the Nernst Balance.** ERNST JÄNECKE (*Zeit. anal. Chem.*, 1904, 43, 547—552).—It is often desirable to be able to estimate with accuracy quantities of mercury not exceeding 0.5 mg. per litre of urine. The use of the Nernst balance (*Abstr.*, 1903, ii, 371) enables this to be done with 250 c.c. of the urine. The organic matter is destroyed by heating the urine with potassium chlorate and hydrochloric acid, and the mercury is then precipitated on a spiral of clean copper wire. The spiral is dried and strongly heated in a test-tube which has been drawn out to a capillary at the open end. The mercury is thus collected in the capillary tube. This is then crushed under a mixture of nitric and sulphuric acids, and, after heating to dissolve the mercury, a little potassium sulphate is added, and the solution, measuring 10 c.c., is electrolysed with a coil of gold wire as cathode and a spiral of platinum wire as anode. These coils are conveniently kept from contact during the electrolysis by placing one inside and the other outside a short glass tube open at both ends. The gold wire is weighed before and after the electrolysis by substituting it for the scale-pan of the Nernst balance. Since the gold absorbs hydrogen during the electrolysis, a correction is made by inserting into the circuit a second similar coil in a cell free from mercury. The actual presence of mercury on the gold should be confirmed by expelling it into a capillary tube containing a trace of iodine. The author has succeeded, by this method, in detecting 0.01 mg. of mercury which had been added to two litres of urine. M. J. S.

**A Modified Form of the Persulphate Method of Estimating Manganese in Iron and Steel.** H. PROCTER SMITH (*Chem. News*, 1904, 90, 237).—The following modification of this process is described: 0.2 gram of the sample, and the same weight of a steel containing a known quantity of manganese are both placed in test-tubes and each gently heated with 10 c.c. of nitric acid of sp. gr. 1.2 until dissolved. The solutions are boiled to expel red fumes, and 10 c.c. of silver nitrate solution (1.7 grams per litre) and about 1 gram of ammonium persulphate are added. After heating until the latter is nearly dissolved, the sides of the tubes are washed down with water and the contents cooled. The perfectly cold pink solutions are then transferred to china basins and titrated with sodium arsenite solution. The latter is prepared by dissolving 5 grams of arsenious oxide and 15 grams of sodium hydrogen carbonate in 250 c.c. of boiling water and diluting to 1 litre. Forty c.c. of this solution diluted to 500 c.c. form the titration solution, which, for each set of analyses, must be standardised on a steel containing a known quantity of manganese. W. P. S.

**Volumetric Estimation of Iron.** NAZARENO TARUGI and S. SILVATICI (*Chem. Centr.*, 1904, ii, 1341—1342; from *Boll. Chim. Farm.*, 43, 637—641).—The solution, which must contain the iron in the ferric state, is carefully neutralised with sodium hydroxide, and after adding some potassium thiocyanate the liquid is titrated with *N*/10 potassium oxalate until the colour changes to yellowish-green. One c.c. of the

oxalate solution = 0.00186673 gram of metallic iron. It is advisable to make a blank experiment using 5 c.c.  $N_{10}$  ferric chloride.

L. DE K.

**Colorimetric Estimation of Iron in Blood.** ADOLF JOLLES (*Zeit. anal. Chem.*, 1904, 43, 537—539).—The author's most recent modification of his original method (*Abstr.*, 1897, ii, 126) consists in comparing the colour of the iron solution obtained from 0.05 c.c. of blood with that of the glass wedge of Fleischl's hæmometer, and he regards the apparatus for this form of estimation, to which he gives the name "clinical ferrometer," as the simplest and most convenient for clinical purposes (compare Oerum, *Abstr.*, 1904, ii, 449). Whereas, in general; the percentage of iron in the blood is proportional to that of the hæmoglobin, in many pathological conditions, such as anæmia, icterus, &c., the relation undergoes a marked alteration. M. J. S.

**Analysis of Commercial Tin and its Alloys.** AUGUSTE HOLLARD and L. BERTIAUX (*Bull. Soc. chim.*, 1904, [iii], 31, 1128—1131).—A complete scheme for the analysis of commercial tin is given. Arsenic is determined by distillation with hydrochloric acid and ferrous sulphate, the distillate being titrated with iodine (*Abstr.*, 1900, ii, 438). The copper, bismuth, and lead are separated from the tin by precipitation as sulphides in presence of ammonium sulphide, and the bismuth and lead from copper by precipitation as sulphides in presence of ammonia and potassium cyanide. Finally, the lead and bismuth are separated and estimated electrolytically as already described (*Abstr.*, 1904, ii, 684). Antimony is estimated by dissolving 1 gram of the tin in nitro-hydrochloric acid, evaporating down repeatedly with hydrochloric acid, adding a little sodium hydroxide to the residue, and electrolyzing under the conditions previously described (*Abstr.*, 1903, ii, 455). For the estimation of copper and sulphur, 5 grams of tin are treated with nitric acid and the whole evaporated to dryness; the residue is washed thoroughly with water containing a little nitric acid, and in these washings the copper is estimated electrolytically and the sulphur by precipitation as barium sulphate. For lead-tin alloys, 1 gram of the alloy is treated with 50 c.c. of nitric acid (water should be added if the alloy is rich in lead) in presence of 10 grams of copper. The liquid is diluted to 300 c.c. and warmed to cause the tin oxide to agglomerate. When cold, the lead is estimated electrolytically as the peroxide (*Abstr.*, 1899, ii, 523; 1904, ii, 294); to obtain the last traces of lead, the anode should be withdrawn when the greater part of the lead has been deposited, and the mixture shaken and left in a warm place for a time. The anode should then be replaced and the electrolysis continued. T. A. H.

**Estimation and Separation of Gold in the Electrolytic Way.** SARAH P. MILLER (*J. Amer. Chem. Soc.*, 1904, 26, 1255—1269).—A lengthy article, unsuitable for adequate abstraction, showing the conditions under which gold can be satisfactorily separated from iron, cadmium, silver, zinc, cobalt, nickel, and copper. The gold is deposited

from solutions containing either potassium cyanide, phosphoric acid, or sodium sulphide. L. DE K.

**Inadmissibility of Soap for Estimating Hardness of Ferruginous Water.** A. GAWALOWSKI (*Zeit. anal. Chem.*, 1904, 43, 533—536).—A sample of well-water containing 0.036 gram of ferrous oxide per litre in the form of sulphate gave, on titration with soap solution, results widely at variance with the amounts of calcium and magnesium estimated gravimetrically, neither could concordance be established by including in the calculation the amount of soap consumed by the iron present. An attempt to titrate with soap, after the removal of the iron by potassium ferrocyanide, also failed to give a satisfactory result. M. J. S.

**Estimation of Ammonia and Proteid-Nitrogen in Waters.** JEAN EFFRONT (*Chem. Centr.*, 1904, ii, 1253—1254; from *Mon. Sci.*, [iv], 18, 669—674).—An accurately titrated solution of bleaching powder is mixed with a definite volume of the sample of water to be tested, and the loss in active chlorine represents the nitrogen of the ammonia and proteids. The experiment is then repeated with water from which the ammonia has been expelled by evaporation with sodium hydroxide; the result is the proteid-nitrogen only.

The active chlorine is estimated by adding excess of sodium arsenite and titrating the excess with standard iodine. L. DE K.

**Addenda to Simple Method for Decarbonising Substances. Estimations in the Decarbonised Product.** ALBERT NEUMANN (*Zeit. physiol. Chem.*, 1904, 43, 32—36. Compare Abstr., 1903, ii, 243).—Further manipulative details are given for the processes and estimations already described. J. J. S.

**Alkaloid Reactions. IV. Morphine.** C. REICHARD (*Chem. Zeit.*, 1904, 28, 1102—1105. Compare Abstr., 1904, ii, 791, 992).—The author communicates a new reaction for morphine which is quite characteristic. If morphine is gently warmed with strong sulphuric acid containing some arsenious or arsenic acid, an intense and permanent purple coloration is developed. In practice, it is best to make a solution of arsenious acid in strong aqueous sodium hydroxide; to this may be added first the morphine and then an excess of very strong sulphuric acid.

Morphine is also coloured red by antimonious chloride without using sulphuric acid. Stannous chloride in conjunction with sulphuric acid also causes the reaction. L. DE K.

**Mechanical Analysis of Soils and Sub-soils by Centrifugal Action; with Notes on Treatment of Samples.** J. R. KILROE (*Econ. Proc. Roy. Dublin Soc.*, 1904, 1, 223—230).—A centrifugal apparatus is described by means of which mechanical separations can be made rapidly and with considerable accuracy. The amount of soil employed for a determination is 20—30 grams, and very little distilled water is required. N. H. J. M.



## General and Physical Chemistry.

**Enhanced Lines of Titanium, Iron, and Chromium in the Fraunhoferic Spectrum.** Sir J. NORMAN LOCKYER and F. E. BAXANDALL (*Proc. Roy. Soc.*, 1904, **74**, 255—267).—The contents of this paper are summarised as follows. The enhanced lines of titanium and iron are practically all represented in the Fraunhofer spectrum, but in some cases the corresponding solar lines are compound and only partly due to one or other of these metals. The corresponding solar lines are, generally speaking, comparatively weak ones. The majority of the chromium enhanced lines occur in the solar spectrum, although some appear to be missing. Some of the Fraunhofer lines correspond with metallic lines special to the spark spectrum, and lacking in the arc, and probably for this reason they were left unoriginised by Rowland.

J. C. P.

**Spectrum Regularities and the Atomic Weight of Radium.** GEORGE RUDORF (*Zeit. physikal. Chem.*, 1904, **50**, 100—110. Compare Runge and Precht, *Abstr.*, 1903, ii, 346; Watts, *Abstr.*, 1904, ii, 720).—The author finds that frequency differences ( $d$ ) and atomic weights ( $A$ ) are not exactly related according to the equation  $d/A^n = \text{const.}$ ; hence the formula  $\log A = a + b \log d$  is not exactly valid, and any considerable extrapolation based on the straight line formula may lead to error. It is shown that certain graphical relationships exist between the values of  $A$  and  $100d/A^2$ , which permit of the calculation of  $d$  for other elements. The value 225 should for the present be taken as the atomic weight of radium.

J. C. P.

**Racemism.** GIUSEPPE BRUNI (*Atti R. Accad. Lincei*, 1904, [v], **13**, ii, 373—381. Compare Bruni and Finzi, this vol., ii, 2; Bruni and Padoa, *Abstr.*, 1902, i, 343).—The freezing-point surface and the course of the isotherms of solutions of mixed optical isomerides give a clue to the molecular condition of the dissolved substances and indicate the existence or non-existence of racemic molecules in the liquid. On adding to a *p*-xylene or ethylene bromide solution of methyl diacetyl-tartrate increasing quantities of methyl diacetyl-racemate, it is found that the freezing-point depressions are always less than the normal values; the molecular weights are hence abnormally great, so that there must be a certain number of undissociated racemic molecules in solution. The abnormality diminishes as the concentration of the racemic compound increases, which must be attributed to the fact that the excess of the diacetyl-tartrate undergoes a continuous relative decrease, its influence in retarding the dissociation thus becoming less. If temperatures are taken as ordinates and total concentrations as abscissae, the freezing points of the solutions of methyl diacetyl-tartrate and diacetyl-racemate and the cryohydrate point of the mixed solutions lie on a straight line, if the racemic compound undergoes complete

dissociation in the solution; where there is partial racemisation, this is no longer the case. The three dimensional curves, obtained with the concentrations of the *d*- and *l*-compounds and the temperature as co-ordinates, also have different forms for the cases where there is partial racemisation and complete dissociation.

Methyl diacetylracemate also exists partially non-dissociated in solution in diphenylmethane or naphthalene, in the latter solvent at temperatures as high as 80°. The freezing-point constant for diphenylmethane is 71, and not 67 as was stated by Eijkman (*Abstr.*, 1890, 324). Ethyl *r*-dibromophenylpropionate is partially non-dissociated in naphthalene solution in presence of the *d*-compound. T. H. P.

**Possibility of Resolving Racemic Compounds by Circularly Polarised Light. The Primary Production of Optically Active Substances.** ALFRED BYK (*Zeit. physikal. Chem.*, 1904, 49, 641—687; *Ber.*, 1904, 37, 4696—4700).—As a starting point, Cotton's experiment is taken, according to which the *d*- and *l*-components of Fehling's solution possess different coefficients of optical absorption for circularly polarised light of definite sign. It can also be shown that the positions of the maxima of optical absorption and of photochemical sensitiveness coincide, and the conclusion is drawn that the extent of decomposition of these sensitive compounds in circularly polarised light is not the same for each. On the strength of Ostwald's work on the independent optical absorption of the ions in dilute solution, the author draws the further conclusion that this difference of sensitiveness persists in the inactive Fehling solution, and must therefore result in this solution gradually becoming active under the decomposing influence of circularly polarised light. For the details of each step in this indirect proof, reference must be made to the original.

The extensive occurrence of optically active compounds in nature may thus be referred to the production in excess of one kind of circularly polarised light at the earth's surface. This result is reached by the reflection of the plane polarised rays of sunlight from the surface of the sea, assisted by the influence of the earth's magnetism.

Incidentally it was found that the same effect was produced by *d*- and by *l*-circularly polarised light on sensitive, optically active photographic preparations (silver tartrate paper and silver bromide plates sensitised with chlorophyll). The progressive dissociation with dilution of a racemic salt was followed in the case of Fehling's solution, and it was shown that the production of the racemic salt obtained by mixing *d*- and *l*-Fehling's solutions is accompanied by a change of colour. J. C. P.

**Formation of Salts in Solution, especially in the Case of Substances Exhibiting Tautomerism (Pseudo-acids, Pseudo-bases).** I. JULIUS W. BRÜHL and HEINRICH SCHRÖDER (*Zeit. physikal. Chem.*, 1904, 50, 1—42).—Full details are given of the spectrochemical investigation of the esters of camphorcarboxylic acid and the sodium derivatives formed from these. The chief conclusions arrived at have already been reported (*Abstr.*, 1904, i, 646 and 969). As a further and secondary result of the investigation, following from observations

made on the variation of the specific refraction of sodium in methyl and ethyl alcohols and its constancy in amyl alcohol (see Abstr., 1904, i, 969), it seems that the value of the specific refraction for the sodium ion is 12—15 per cent. less than the value for sodium in an unionised compound.

J. C. P.

**Luminescope for Comparing Substances under the Influence of Radium Rays.** C. S. STANFORD WEBSTER (*J. Soc. Chem. Ind.*, 1904, 23, 1185—1186).—The instrument has been designed to facilitate the comparison of different substances in regard to their "glow" and scintillating power under the influence of radium rays. It resembles the spinthariscopes, but the draw tube with the system of lenses is mounted on one side of a circular metal box which contains a metal disc carrying four screens. By turning a handle, the disc can be rotated and the screens brought into position under the observation tube as required. One of the screens is temporarily fixed by wire-spring clips and can be replaced at will.

H. M. D.

**Induced Radioactivity.** KARL A. HOFMANN, L. GONDER, and VALENTIN WÖLFL (*Ann. Physik*, 1904, [iv], 15, 615—632. Compare Abstr., 1902, ii, 261, 397; 1903, ii, 402).—Although a uranium salt can be separated into a more and a less active portion, the two portions finally exhibit the same activity (compare Becquerel, Abstr., 1902, ii, 117), so that uranium is itself a radioactive element. When small quantities of salts of other metals are dissolved in concentrated solutions of uranium nitrate, and, after a few weeks, are separated from the uranium by chemical methods, the precipitated sulphate, sulphide, or oxalate, as the case may be, is found to have an induced radioactivity, which gradually disappears. The degree of activity of the precipitate depends on the nature of the inactive metal it contains; thus the activity transmitted to lead and bismuth sulphides is much greater than that transmitted under similar conditions to the sulphides of palladium, platinum, and mercury. When two inactive metals acquire an induced activity from the same uranium solution, their relative activity is independent of the order in which they have been separated from the solution. When the metals are arranged according to the relative activity induced under the above conditions, the order is roughly the same, whether uranium or radium is used as the inducing agent, but is quite different when radiolead or radiobismuth is the inducing agent. For iridium, palladium, rhodium, and platinum are distinguished by the marked activity which is induced in them by radiolead. The chloride in each case was kept for three weeks in common solution with radiolead chloride, and then the metal was precipitated by formaldehyde or hydroxylamine. The  $\alpha$ -activity thus induced on these metals is removed on ignition at a bright red heat, but the  $\beta$ -activity is only slightly diminished by that treatment. This observation leads to the suggestion that the  $\alpha$ -activity is occluded, but, in conflict with this view, it has been shown for platinum that the activity of the metal is not greater than that of the sulphide obtained by precipitation from the same radiolead solution. At the ordinary temperature, the induced  $\beta$ -activity disappears more rapidly than the



**$\alpha$ -activity.** When the metals palladium, iridium, and silver (platinum and gold in a less degree) in the solid form have been immersed for several days in an active lead chloride solution, obtained from pitchblende and kept at 60°, they exhibit marked radioactivity. When active bismuth salts prepared from pitchblende are used as inducing agents in the manner previously described, they lose their own activity and do not regain it, in contrast to the radiolead preparations. The process of induction is supposed to consist in the emission of particles from the primarily active substance, those particles adhering then to the atoms and ions which are susceptible to the induction. J. C. P.

**Action of Radium Rays on Caoutchouc.** RUDOLF DITMAR (*Chem. Centr.*, 1904, ii, 1652—1653; from *Gummi-Zeit.*, 19, 3—4. Compare Abstr., 1904, i, 757).—The power of radium rays of penetrating caoutchouc has been examined by Madame Curie's radiographic method. A "concentrated" preparation of de Haen's radium barium bromide was used, but the action of this substance was not sufficiently powerful to induce radioactivity in the caoutchouc itself. The following conclusions have been derived from the results of the experiments of the author and the investigations of Madame Curie. The radium rays ( $\gamma$ -rays) penetrate both crude and vulcanised rubber, but the former more readily than the latter, probably owing to its porosity. Caoutchouc itself may be rendered radioactive (Madame Curie). The loss of activity of caoutchouc in air does not take place in accordance with the law which usually obtains for solids. E. W. W.

**Variation of the Resistance of Bismuth in a Feeble Magnetic Field.** C. CARPINI (*Nuovo Cim.*, 1904, [v], 8, 171—186).—The variation of the resistance of bismuth in both feeble and strong magnetic fields is a hyperbolic function of the strength of field, and is also a sine function of the angle made by the coil of bismuth with the lines of force. No hysteresis phenomena were observed on changing the strength of field. When an alternating current is employed, the change of resistance is far smaller than with the corresponding direct current. The curves appear to depend in a very complicated manner on the amplitude and period of the alternating current. T. H. P.

**Electric Conductivity of Phosphorus Emanation and of Freshly Prepared Gases.** EUGÈNE BLOCH (*Ann. Chim. Phys.*, 1905, [viii], 4, 25—144. Compare Abstr., 1903, ii, 206; 1904, ii, 117).—The electric conductivity of dry air which has passed over phosphorus or of freshly prepared gases (such as hydrogen or carbon dioxide obtained by the action of acid on metals or marble respectively) is in each case due to the same cause, namely, the presence of ions which differ in their mobility and their coefficient of recombination from the ordinary ions. M. A. W.

**Electrolytic Conductivity of Colloidal Solutions.** G. E. MALFITANO (*Compt. rend.*, 1904, 139, 1221—1223).—Carefully purified

colloidal solutions have an electrolytic conductivity greater than that of water; this is, however, due to the small quantity of soluble electrolytes unavoidably present in such solutions, and not to the colloidal granules themselves, which appear to be without electric charge, for the clear liquid obtained after filtering a colloidal solution through a collodion membrane has the same electrolytic conductivity as the original solution or the residual liquid rich in colloidal granules; thus a solution of ferric chloride, which had been heated to  $100^{\circ}$  and contained 0.371 per cent. of chlorine and 0.132 per cent. of iron, had  $k=0.02301$ , the clear colourless filtrate contained 0.367 per cent. of chlorine and 0.077 per cent. of iron, and had  $k=0.02299$ , and the residual colloidal liquid contained 0.380 per cent. of chlorine, 0.182 per cent. of iron, and had  $k=0.02273$ , and similar results were obtained with colloidal solutions of arsenic pentasulphide, or white of egg.

M. A. W.

**Conductivities of Certain Electrolytes in Water, Methyl and Ethyl Alcohols, and Mixtures of these Solvents. Relation between Conductivity and Viscosity.** HARRY C. JONES and CHARLES G. CARROLL (*Amer. Chem. J.*, 1904, 32, 521—583. Compare Jones and Lindsay, *Abstr.*, 1903, ii, 55).—The conductivity of cadmium iodide has been determined at  $0^{\circ}$  and  $25^{\circ}$  in water, methyl and ethyl alcohols, and mixtures of water with each of these alcohols. The determinations were made at dilutions varying from 16 to 256. The results show that cadmium iodide does not exhibit a minimum in mixtures of methyl alcohol and water at  $25^{\circ}$ , but that a minimum appears at  $0^{\circ}$  in a mixture containing 75 per cent. of the alcohol at concentrations of not less than 64, but disappears at greater dilutions. In mixtures of ethyl alcohol and water at  $25^{\circ}$ , no minimum is observed.

Determinations of the conductivity of sodium iodide at  $0^{\circ}$  and  $25^{\circ}$  in water and in methyl alcohol of 25, 50, and 75 per cent. strength have shown that a minimum is exhibited, but is more pronounced at  $0^{\circ}$  than at  $25^{\circ}$ . At  $25^{\circ}$ , a minimum occurs in 75 per cent. methyl alcohol at a concentration of 32, but beyond this dilution the minima are only observed in the 50 per cent. mixture. At  $0^{\circ}$ , the minimum appears in the 50 per cent. mixture only.

The conductivity of solutions of calcium nitrate in water, methyl alcohol, ethyl alcohol, and mixtures of each of these alcohols with water was determined at  $0^{\circ}$  and  $25^{\circ}$ , but in no case was a minimum observed.

Determinations of the conductivity of hydrogen chloride in methyl alcohol of 50, 69.75, 90, and 100 per cent. strength gave results which show that in each case the molecular conductivity decreases as the concentration increases. In the 69.75 per cent. mixture, a maximum is obtained both at  $0^{\circ}$  and  $25^{\circ}$ . In the 90 per cent. mixture, the results are regular, and a limiting value is reached at a dilution of 157.67. It is found that hydrochloric acid shows a minimum both in the 69.75 and the 90 per cent. mixtures. At  $25^{\circ}$ , the minimum appears at a dilution 178.75, and at  $0^{\circ}$  it appears at all dilutions.

The conductivity of sodium acetate in acetic acid of 25, 50, 75, and

100 per cent. strengths was determined at 25°, but the results were irregular and led to no definite conclusions.

The dissociation of potassium iodide, sodium iodide, ammonium bromide, ammonium iodide, and lithium nitrate in 50 per cent. methyl alcohol was calculated from conductivity determinations. In the case of potassium and sodium iodides, it was found that the dissociation is greater in the mixture of methyl alcohol and water than in either of the pure solvents, and that the dissociation of potassium bromide is greater in the mixture than in pure water.

The dissociation of hydrochloric acid in methyl alcohol of 69.75 per cent. strength is also greater than in water at the corresponding dilution, but this is not the case for the 90 per cent. alcohol.

The dissociation of potassium and sodium iodides in water, methyl alcohol, and ethyl alcohol is found to agree quantitatively with the hypothesis of Dutoit and Aston (Abstr., 1897, ii, 456).

It is suggested that the greater dissociation found in the 50 per cent. mixture of methyl alcohol and water is due to the presence of a hydrate,  $\text{CH}_3\cdot\text{OH}\cdot 3\text{H}_2\text{O}$ , formed by the association of four simple molecules, whereas in water the number of molecules associated with one another at the ordinary temperature is less than four.

An explanation has been suggested by Jones and Lindsay (*loc. cit.*) to account for the occurrence of the minimum point in the conductivity values. It is now shown, however, that this explanation is not altogether satisfactory, and that the decrease in the conductivity of electrolytes in binary mixtures of various alcohols and water, sometimes accompanied by a minimum conductivity, is due mainly to a diminution in the fluidity, produced on mixing the solvents, and the consequent decrease in ionic mobility.

The hypothesis of Kohlrausch (Abstr., 1903, ii, 403) that each ion is invested with an atmosphere of the solvent of considerable thickness is shown to be true in the case of binary electrolytes, not only in aqueous solutions, but also in methyl and ethyl alcohols.

The relation between conductivity, association, and viscosity is discussed, and the hypothesis is put forward that the conductivities of comparable, equivalent solutions of binary electrolytes in certain solvents, such as methyl and ethyl alcohols and acetone, are inversely proportional to the coefficient of viscosity of the solvent and directly proportional to its association factor. This relation has been tested in a number of cases and found to be true in each.

The results of the experiments are tabulated and are also plotted as curves.

E. G.

**Relation between the Size of the Molecular Complex and the Temperature-coefficient of Expansion in Different States of Aggregation.** WILHELM VAUBEL (*J. pr. Chem.*, 1904, [ii], 70, 503—508).—As the molecular vibrations and the consequent temperature-coefficients of expansion of a substance in the gaseous and in the liquid states of aggregation must be in direct proportion to the size of the molecules, it is proposed to calculate the number of gas-molecules associated in the liquid-molecule from the relation to each other of the coefficients.



The results so obtained agree with those from other methods for chlorine, bromine, phosphorus, bismuth, water, ether, acetone, and methyl, ethyl, and propyl alcohols; in most other cases, the results are too high. Contrary to previous determinations of the molecular weights of homologous series of organic compounds in the liquid state, the value obtained by the present method increases with the vapour density.

G. Y.

**Effect of Mechanical Vibration on Carbon Dioxide near the Critical Temperature.** WALTER P. BRADLEY, A. W. BROWNE, and C. F. HALE (*Physical Review*, 1904, 19, 258—272).—When a system containing both liquid and gaseous carbon dioxide between temperatures of  $29^{\circ}$  and  $31.2^{\circ}$  is subjected in a Cailletet apparatus to proper mechanical vibration, a peculiar fog effect is produced. This is due, not to impurities in the gas, but to a change of state in the liquid and vapour phases, resulting respectively in the formation of minute bubbles and drops. The change of state is produced by alternate compression and dilatation effected by the vibrations of a steel rod clamped to the pressure jacket of the apparatus. Under given conditions of temperature, pressure, length of mercury column, and relative volume of the phases, vibrations of a certain definite pitch are required in order to produce the fog effect. The present paper deals with the measurement of variables determining the pitch of the effective vibrations.

J. C. P.

**Regularities in Homologous Series.** OTTO BIACH (*Zeit. physikal. Chem.*, 1904, 50, 43—64).—It is well known that in certain homologous series the melting point alternately rises and falls (compare also Lamouroux, *Abstr.*, 1899, i, 479; Henry, *ibid.*, 735), and in the present paper the author attempts to show that this oscillatory variation is characteristic of all physical constants. When the constants themselves vary more or less regularly, their differences may be found to oscillate, or the differences between these first differences may exhibit the required peculiarity. By way of explanation, the author makes the supposition that the valency of hydrogen is not exactly one-fourth that of carbon.

J. C. P.

**Rate of Chemical Auto-heating (Adiabatic Reaction Kinetics).** GEORGE BREDIG and F. EPSTEIN (*Zeit. anorg. Chem.*, 1904, 42, 341—352).—A theoretical paper in which the following question is discussed. Given a chemically reactive system of the initial concentration  $a$  and having at constant temperature the rate constant  $kT_x$ , which is variable with the temperature  $T_x$ , whilst in the reaction in question the amount of heat,  $q$ , is evolved for each formula-weight,  $g$ ; it being assumed that the reaction proceeds in a vessel impermeable to heat, so that the system is thus heated or cooled by its own heat of reaction. After what period of time,  $z$ , will a definite temperature  $T_x$  and at the same time a definite chemical transformation,  $x$ , be reached?

To illustrate the equations deduced, the action  $2\text{H}_2\text{O}_2 = 2\text{H}_2\text{O} + \text{O}_2$  was studied under the catalytic influence of potassium iodide and, so far as possible, under adiabatic conditions. At a definite time,  $a$

mixture of hydrogen peroxide and potassium iodide was introduced into a Dewar-Weinhold flask and the auto-heating of the system estimated after definite intervals of time.

A. MCK.

**Some Thermochemical Rules relating to the Possibility and Prognostication of Reactions.** MARCELLIN BERTHELOT (*Compt. rend.*, 1904, 139, 1005—1009).—A theoretical paper not suitable for abstraction.

M. A. W.

**Thermochemical Studies.** DANIEL LAGERLÖFF (*J. pr. Chem.*, 1904, [ii], 70, 521—559. Compare Abstr., 1904, ii, 382, 605).—The conclusion of the author's mathematical discussion of the theory of the heat of formation of carbon compounds.

G. Y.

**Combustion of Sulphur in the Calorimetric Bomb.** H. GIRAN (*Compt. rend.*, 1904, 139, 1219—1221).—The author has measured the heat of combustion of sulphur in oxygen in a calorimetric bomb under varying pressures, estimated the sulphur dioxide and sulphur trioxide in the gaseous products, and calculated the heat of formation of sulphur dioxide under different pressures; the results show that the heat of formation of sulphur dioxide and the proportion of sulphur converted into the trioxide increase with the pressure, and the following table comprises the results:

Pressure.	Heat of formation of SO <sub>2</sub> .	Ratio of weight of sulphur converted into trioxide to total weight of sulphur.
1 atmos.	69·80 Cal. (by extrapolation)	—
2·5 "	70·43 "	0·142
5 "	71·60 "	0·165
10 "	72·19 "	0·184
15 "	74·45 "	0·188
20 "	75·52 "	0·219
25 "	77·88 "	0·228
30 "	78·41 "	0·272
35 "	80·26 "	0·294
40 "	80·88 "	0·307
45 "	81·13 "	0·312

It is probable that the increase with the pressure in the heat of formation of sulphur dioxide is due to the formation of a higher oxide of sulphur, as the residue contained in the bomb shows the characteristic properties of the anhydride of persulphuric acid.

The heat of formation of sulphur dioxide under atmospheric pressure is 69·80 Cal.

M. A. W.

**Villari's Critical Point in the Case of Nickel.** K. HONDA and S. SHIMIZU (*Ann. Physik*, 1904, [iv], 15, 855—859).—The authors adhere to their former conclusion (*Ann. Physik*, 1904, [iv], 14, 791), that nickel does not exhibit this critical point.

J. C. P.

**Fusion of Dissociating Compounds and the Degree of Dissociation of the Fused Substance.** ROBERT KREMANN (*Monatsh.*, 1904, 25, 1215—1269).—From theoretical considerations, it

is shown that, if curves are constructed with melting points as ordinates and molecular percentages of one substance, which forms an additive compound with the other, as abscissæ, the more strongly the additive compound dissociates on melting, the flatter is the curve near the maximum at its melting point.

The melting point of the additive compound is affected less by addition of one of the components than of an indifferent substance, as the former takes part in the equilibrium between the additive compound and its components. The molecular depression of the melting point of the additive compound is calculated from the heat of fusion, or is determined directly by addition of indifferent substances, unless these act as solvents, when the molecular depression produced increases with the dielectric constant.

The extent to which the additive compound dissociates on melting can be determined within 1 per cent. by comparison of the theoretical with the experimental curve. The additive compound of aniline with phenol has the molecular depression of the melting point,  $\Delta = 0.278^\circ$ , and, when fused, dissociates to the extent of 20 per cent. The curve for mixtures of phenol and picric acid has eutectic points at  $36^\circ$  and  $80^\circ$  for mixtures containing 7 and 59 molecular per cent. respectively of picric acid; the additive compound has  $\Delta = 0.401^\circ$  and a dissociation degree of 27 per cent. For mixtures of trinitrotoluene and naphthalene, the curve has eutectic points at  $72^\circ$  and  $71^\circ$ , representing 12 and 85 molecular per cent. respectively of trinitrotoluene; the additive compound melts at  $96.5^\circ$ . The curve for the mixtures of naphthalene and picric acid (compare Saposechnikoff and Rdultowsky, *Abstr.*, 1904, i, 399) has eutectic points at  $78^\circ$  and  $111^\circ$  for mixtures containing 4 and 92 molecular per cent. respectively of picric acid; the additive compound melts at  $147^\circ$ . The mixtures of nitroso-dimethylaniline and aniline show eutectic points at  $-10^\circ$  and  $75^\circ$ , representing 2.5 and 90 molecular per cent. respectively of nitroso-dimethylaniline; the additive compound contains 33 molecular per cent. of aniline, melts at  $93^\circ$ , has  $\Delta = 0.202^\circ$ , and, when melted, dissociates to the extent of 15 per cent. G. Y.

**Influence of Substitution in the Components on the Equilibrium of Binary Solutions.** ROBERT KREMANN (*Monatsh.*, 1904, 25, 1271—1310. Compare foregoing abstract).—The melting point curve of mixtures of 2:4-dinitrotoluene and naphthalene has eutectic points at  $53^\circ$  and  $56^\circ$  for mixtures containing 28 and 69 molecular per cent. respectively of naphthalene; the maximum for the additive compound is  $59^\circ$ . The curve for mixtures of nitrotoluene and naphthalene falls to one eutectic point at  $27^\circ$  for a mixture containing 38 molecular per cent. of nitrotoluene. The curve for mixtures of trinitrobenzene and naphthalene falls to eutectic points at  $77^\circ$  and  $114^\circ$  for mixtures containing 8 and 88 per cent. respectively of naphthalene; the maximum for the additive compound (Hepp, *Abstr.*, 1883, 317) lies at  $151^\circ$ . The curve for mixtures of *m*-dinitrobenzene and naphthalene falls to eutectic points at  $50.3^\circ$  and  $50.5^\circ$  for mixtures containing 60 and 42 molecular per cent. of naphthalene; the curve between the eutectic points is extremely flat, the maximum,



the melting of the easily dissociated additive compounds, lies at  $50.8^{\circ}$ ; such mixtures are termed by the author  $\psi$ -isomorphic. The curve for mixtures of nitrobenzene and naphthalene falls to one eutectic point at  $-6.8^{\circ}$  for a mixture containing 14 molecular per cent. of naphthalene.

The curve for mixtures of *o*-nitrophenol and naphthalene has one eutectic point at  $30^{\circ}$  for a mixture containing 30 molecular per cent. of naphthalene.

The curve for mixtures of *p*-nitrophenol and naphthalene falls to a eutectic point at  $73^{\circ}$  for a mixture containing 77 molecular per cent. of naphthalene.

The curve for mixtures of *s*-trinitrobenzene and aniline has a eutectic point at  $101^{\circ}$  for a mixture containing 18 molecular per cent. of aniline, and another at  $-6^{\circ}$  for a mixture containing 0.3—0.7 molecular per cent. of trinitrobenzene; the maximum at  $125^{\circ}$  represents an equimolecular mixture.

The curve for mixtures of *m*-dinitrobenzene and aniline falls from the melting point of dinitrobenzene to  $40^{\circ}$ , where there is a break, and then to a eutectic point at  $-8^{\circ}$  for a mixture containing 4 molecular per cent. of *m*-dinitrobenzene; the break at  $40^{\circ}$  represents an additive compound containing 20 molecular per cent. of *m*-dinitrobenzene, which melts at  $40^{\circ}$ .

Mixtures of nitrobenzene and aniline give a curve which falls to a eutectic point at  $-29.8^{\circ}$  for a mixture containing 41 molecular per cent. of nitrobenzene.

The curve for mixtures of trinitrotoluene and aniline falls to eutectic points at  $60^{\circ}$  and  $-8^{\circ}$  for mixtures containing 85 and 1.5 molecular per cent. respectively of trinitrotoluene; the maximum between the eutectic points is  $85^{\circ}$ .

The curve for mixtures of dinitrotoluene and aniline falls in an almost straight line from the melting point of the former to a eutectic point at  $-13^{\circ}$  for a mixture containing 11 molecular per cent. of dinitrotoluene.

The curve for mixtures of nitrotoluene and aniline has one eutectic point at  $-17^{\circ}$  for a mixture containing 15 molecular per cent. of nitrotoluene.

G. Y.

**Additive Compounds of Nitrosodimethylaniline.** ROBERT KREMANN (*Monatsh.*, 1904, 25, 1311—1329. Compare foregoing abstracts).—Examination of the melting point curves for mixtures of nitrosodimethylaniline with *p*-toluidine, *o*-toluidine, *m*-xylydine,  $\beta$ -naphthylamine, and phenol shows that the following additive compounds are formed. The percentages are in molecular equivalents.

The additive compound with *p*-toluidine contains 66.6 per cent. of nitrosodimethylaniline; the eutectic points at  $28^{\circ}$  and  $48.5^{\circ}$  represent mixtures containing 27 and 33.4 per cent. of *p*-toluidine.

The additive compound with *o*-toluidine contains 66 per cent. of nitrosodimethylaniline, and melts at about  $70^{\circ}$ ; the eutectic points at  $67^{\circ}$  and below  $-18^{\circ}$  represent mixtures containing 26 and over 95 per cent. of *o*-toluidine.

The additive compound with  $\beta$ -naphthylamine contains 60 per cent. of nitrosodimethylaniline and melts at  $86^{\circ}$ ; the eutectic points at  $81^{\circ}$

and 75° represent mixtures containing 35 and 82 per cent. of nitrosodimethylaniline. The additive compound with phenol contains 66.6 per cent. of nitrosodimethylaniline and melts at 91°; the eutectic points at 24° and 74° represent mixtures containing 21 and 88 per cent. of nitrosodimethylaniline.

Two additive compounds are formed with *m*-xylidine; the one contains 60 per cent. of nitrosodimethylaniline and melts at 48°; the other contains 25 per cent. of nitrosodimethylaniline and melts at 26°; the eutectic points at 46.5°, 25°, and below -11° represent mixtures containing 63, 30, and about 2 per cent. of nitrosodimethylaniline.

The melting point curve for mixtures of nitrosobenzene and aniline falls to a eutectic point at -13° for a mixture containing 19 per cent. of aniline; no additive compound is formed. G. Y.

**Polymerisation in the Liquid and Solid States.** GEORGE G. LONGINESCU (*Ann. Sci. Univ. Jassy*, 1904, 3, 26—34. Compare Abstr., 1904, ii, 112; 1903, ii, 531).—Making use of the relationship  $(T/C.D)^2 = n$ , conclusions are drawn in regard to the state of aggregation of a number of organic substances containing bromine or iodine, of several organo-metallic compounds, and of various inorganic substances in the solid or liquid condition. The bromo- and iodo-derivatives and the organo-metallic compounds consist of simple molecules; this is also the case for the chlorides and bromides of arsenic and antimony, for chromyl chloride, germanium chloride, nickel carbonyl, lead tetrachloride, and selenium oxychloride. Other inorganic compounds, for example, lead chloride, lead bromide, and cadmium chloride, consist of very complex molecules, the association factor being greater than 50.

The value of *C* appears to be a function of the atomic weights of the constituent elements, and a method of ascertaining it is described.

The relationship is also applied to the elements, and the molecular complexity of 45 elements in the solid state and 13 in the liquid state is deduced. It would appear that carbon, silicon, lithium, and calcium contain more than 200 atoms in the molecule, glucinum, magnesium, and strontium more than 100. Sodium and potassium appear to be more highly polymerised in the liquid than in the solid state. Generally speaking, in any periodic group the degree of polymerisation decreases as the atomic weight increases. H. M. D.

**Distribution of Soluble Substances between Water and Amyl Alcohol.** WALTER HERZ and HERBERT FISCHER (*Ber.*, 1904, 37, 4746—4753).—Measurements are given of the constants of distribution between water and amyl alcohol of several acids and bases. In the case of the weaker acids (phenol and acetic acid), a constant value is obtained for all concentrations, but in the case of the stronger acids (succinic, oxalic, and picric acids) allowance has to be made for their degree of dissociation, a constant value for different concentrations being then obtained for the distribution of the undissociated substance. With the bases ammonia, methylamine, and triethylamine, the constant is independent of the concentration.

The distribution ratio of iodine between the two solvents is constant

for all concentrations. But with amyl alcohol and aqueous potassium iodide very different values are obtained for different concentrations, the ratio being also dependent on the nature of the potassium iodide solution.

W. A. D.

### Determination of Molecular Weights in Solid Solutions.

FRIEDRICH W. KÜSTER [with WALTER WÜRFEL] (*Zeit. physikal. Chem.*, 1904, **50**, 65—80. Compare Abstr., 1894, ii, 274; 1895, ii, 439).—The freezing point curve for mixtures of *p*-dichloro- and *p*-dibromo-benzenes ascends regularly from the freezing point of the former to that of the latter, and is slightly convex to the concentration axis. The separating solid in each case is therefore an isomorphous mixture of the two constituents. The composition of the liquid phase in equilibrium with each isomorphous mixture may be deduced from its boiling point, for the boiling point curve of mixtures of the two substances is regular and somewhat similar in form to the freezing point curve. The solubility of the isomorphous mixtures in slightly diluted ethyl alcohol has also been determined, and these solubility experiments indicate that the molecules of the crystallised compounds are on the average greater than  $C_6H_4Cl_2$  and  $C_6H_4Br_2$ , but smaller than  $(C_6H_4Cl_2)_2$  and  $(C_6H_4Br_2)_2$ . The increase of solubility from the value for pure *p*-dibromobenzene is nearly proportional to the percentage of *p*-dichlorobenzene in the isomorphous mixture.

Mixtures of 2 : 4 : 6-trichlorophenol and 2 : 4 : 6-tribromophenol have been similarly investigated. The former compound is dimorphous, and the form which primarily separates on solidification is labile at the ordinary temperature. Tribromophenol does not exhibit dimorphism, and the form in which it separates on solidification is isomorphous with that form of trichlorophenol which is stable at the ordinary temperature. The freezing point of each compound is lowered by the addition of the other, and mixed crystals separate from the liquid mixtures; the mixed crystal series, however, exhibits a gap. The solubility of mixtures of the two substances in dilute methyl alcohol was studied. It is found that whilst the composition of the solutions changes regularly, the mixed crystals in equilibrium with the solutions undergo at one point an abrupt change both in appearance and in composition. When the concentrations of the chloro- and bromo-compounds in solution are plotted against the molecular concentration of the bromo-compound in the solid phase, two straight lines are obtained for each compound, corresponding with the labile and stable forms. The solubility of each form of trichlorophenol is proportional to its concentration in the solid phase, the solubility of the labile form being greater than that of the stable form. In the case of the mixed crystals containing labile tribromophenol, the solubility of the latter is proportional to its concentration in the solid phase, but on the other hand the solubility of the stable form of tribromophenol increases as its concentration in the solid phase diminishes. This peculiarity is probably due to an associating tendency on the part of tribromophenol, and this view is supported by determinations of the molecular weight in alcoholic solution.

J. C. P.



**Stoichiometrical Laws and the Atomic Theory.** LOUIS HENRY (*Bull. Acad. Roy. Belg.*, 1904, 975—983).—The author disagrees with Ostwald's view that, since the stoichiometrical laws are deducible from the principles of chemical dynamics, the atomic theory has become unnecessary for this purpose (*Trans.*, 1904, 85, 508).

T. A. H.

**Lecture Experiments.** [Liquid Ozone. Solid Nitrogen.] HUGO ERDMANN (*Ber.*, 1904, 37, 4739—4744).—An apparatus is described for storing and manipulating a solution of liquid ozone in liquid air: also another apparatus used for the preparation of solid nitrogen by rapidly boiling off the liquid gas, and suitable for demonstration on the lecture table.

E. F. A.

**Bunsen Burner with Sieve Attachment.** FELIX ALLIHN (*Chem. Zeit.*, 1905, 29, 34).—A piece of gauze is attached to the top of the ordinary Marshall burner, whereby a flame is obtained which is uniformly hot and especially suitable for heating platinum vessels.

A. McK.

## Inorganic Chemistry.

**Atomic Weight of Iodine.** PAUL KÖTHNER and E. AEUER (*Annalen*, 1904, 337, 123—169).—A preliminary account of this determination of the atomic weight of iodine has already been published (*Abstr.*, 1904, ii, 556). In the present paper, the earlier work on this subject is discussed, more especially the recent work of Ladenburg. A detailed account of the methods employed in purifying the material and of the apparatus used in the various experiments is given. In discussing the results, it is pointed out that the new value for the atomic weight of iodine, 126.03 ( $H = 1$ ), agrees more closely with the values given by Ladenburg (126.008) and by Scott (126.01 and 126.03) than with Stas's mean value (125.90).

K. J. P. O.

**Revision of the Atomic Weight of Iodine.** GREGORY P. BAXTER (*J. Amer. Chem. Soc.*, 1904, 26, 1577—1595).—Determinations of the atomic weight of iodine have been made by converting a known weight of pure silver into silver iodide. The silver was dissolved in nitric acid, and the solution was diluted with water and afterwards boiled to remove nitrous acid and nitrogen oxides. The solution was now treated with an excess of ammonia and afterwards with dilute solution of pure ammonium iodide prepared from highly purified iodine. Great precautions were taken in the purification of the materials and the collection of the silver iodide. Two samples of iodine were employed, one of which was collected in four fractions, the element being liberated from hydriodic acid by the action of potassium permanganate, which was

added in four successive quantities, distillation being carried out after each addition. The average result of 15 experiments gave the atomic weight of iodine 126.973 ( $\text{Ag} = 107.930$ ), a result which is probably slightly too low. The very small differences in the results show that the samples of iodine were identical, and lead to the conclusion that no new halogen of higher atomic weight than iodine existed in the material employed in the investigation.

In another series of experiments, the ratio of silver to iodine was investigated by ascertaining the exact weight of silver required to combine with a weighed quantity of iodine. The average of three determinations gave the atomic weight of iodine 126.977.

In a third series of experiments, four determinations of the ratio of silver iodide to silver chloride were made by converting a weighed quantity of pure silver iodide into the chloride by heating it in a quartz crucible in a current of chlorine. Two determinations were made by heating silver iodide in a current of carbon dioxide and bromine and afterwards in chlorine. From the ratios obtained in these six experiments, the average atomic weight of iodine was found to be 126.975 ( $\text{Ag} = 107.930$ ;  $\text{Cl} = 35.467$ ;  $\text{O} = 16$ ). The close agreement of this result with the average of the results of the first two series indicates that the atomic weight of iodine is 126.975, and is additional evidence in favour of the value 35.467 for the atomic weight of chlorine which was found by Richards and Wells in an investigation hitherto unpublished.

In connection with the experiments described in this paper, the sp. gr. of pure fused silver iodide was determined and found to be 5.674 at  $25^{\circ}/4^{\circ}$ .  
E. G.

**Flowers of Sulphur and Sublimed Sulphur.** A. DOMERGUE (*Ann. Chim. anal.*, 1904, 9, 445—449).—According to the author, the name of *Flowers of sulphur* should be restricted to samples which, when newly made contain a minimum of 33 per cent. of sulphur insoluble in carbon disulphide. If containing less than this, the name sublimed sulphur should be applied.  
L. DE K.

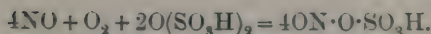
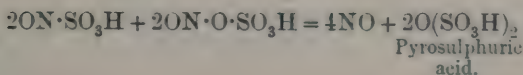
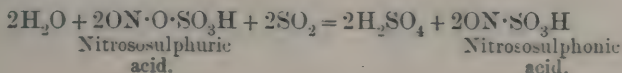
**Contact Method for the Manufacture of Sulphuric Acid.** FRIEDRICH W. KÜSTER [with FRANKE and GEIBEL] (*Zeit. anorg. Chem.*, 1904, 42, 453—469).—In order to maintain a uniform current of the mixture of sulphur dioxide and oxygen, the gases were passed from a copper gasholder, which is described in detail. Platinum, vanadium pentoxide, and ferric oxide induce for equal temperatures the same state of equilibrium between sulphur dioxide, oxygen, and sulphur trioxide. Platinum is the most effective of the three catalysts mentioned and is the only one of technical importance. Water has considerable influence on the catalytic activity of ferric oxide and vanadium pentoxide.

The catalytic effect of ferric oxide is impaired by its sensitiveness towards mechanical and chemical influences. The effect of increasing amounts of arsenious oxide on it is gradually to destroy its activity. Vanadium pentoxide is not, however, so sensitive in this respect.

A. McK.

**Raschig's Theory of the Lead-chamber Process.** EDWARD DIVERS (*J. Soc. Chem. Ind.*, 1904, 23, (24), 1178—1182).—The author gives a *résumé* of the facts adduced in support of the theories of Lunge and of Raschig and suggests a modification of Raschig's theory. According to this view, there is no significant quantity of any oxide of nitrogen in the actually gaseous part of the contents of the chamber in those regions where the change is in active operation, but nitrogen peroxide is present where the activity is much less. On entering the chamber from the Glover tower, the whole of the oxides of nitrogen together with sulphur dioxide and water condense to form a mist; sulphur dioxide, oxygen, and water then condense together upon the liquid particles of the mist and unite under the catalytic influence of the nitrous acid present in the particles.

In Raschig's theory of the chamber process, there is no place for nitrososulphuric acid, although, according to Lunge, its presence is certain and of prime importance. In the author's opinion, the nitrous acid in the liquid mist particles is present in the form of nitroso-sulphuric acid, which is to be looked on as a mixed anhydride of pyrosulphuric and nitrous acids, and the mechanism of the process can be expressed by writing nitroso-sulphuric acid for nitrous acid in Raschig's equations:



According to this, two molecules of sulphur dioxide and one molecule of oxygen are absorbed simultaneously by the liquid mist particles, and under the influence of the catalyser, which is supposed to be alternately nitrososulphuric acid and nitrososulphonic acid, sulphuric acid is continuously produced.

H. M. D.

**Electrolytic Preparation of Persulphates.** CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE & ERICH MÜLLER (D.R.-P. 155805. Compare Müller and Friedberger, *Abstr.*, 1902, ii, 450; and Levi, *Abstr.*, 1903, ii, 474).—In the preparation of potassium persulphate by electrolysis without a diaphragm, the yield is greatly increased by the addition of hydrofluoric acid, becoming equal to that obtained in the preparation of ammonium persulphate. Potassium persulphate may thus be prepared directly, instead of by double decomposition from the ammonium salt. There is no loss of fluorine, and the anode remains bright throughout the process. In the electrolysis of ammonium sulphate, the yield of persulphate is not increased, but no evolution of nitrogen is observed. The influence of fluorine ions on electrolytic oxidation has been observed by Skirrow (*Abstr.*, 1903, ii, 69).

C. H. D.



**Action of Hydrogen Sulphide on Selenious Acid. I. Sensitiveness of Selenium Sulphide towards Light.** ALEXANDER GUTBIER and J. LOHMANN (*Zeit. anorg. Chem.*, 1904, 42, 325—328).—When the yellow hydrosol, obtained by passing hydrogen sulphide into an aqueous solution of selenious acid, is boiled in presence of hydrochloric acid, a bright red precipitate is formed. This formation of the red hydrogel may also be induced by the influence of light. From the experiments described, it appears that the formation of red selenium sulphide is conditioned by the four factors, heat, time, light, and pressure. A. McK.

**Reactions between Nitric Oxide and Oxygen or Atmospheric Air.** GEORG LUNGE and E. BERL (*Chem. Zeit.*, 1904, 28, 1243—1245).—The formation of nitric acid by the action of an excess of oxygen on nitric oxide is chiefly dependent on the amount of water present. With an optimum of the latter, nitric acid is formed in quantitative yield; with larger amounts of water, nitrous acid is formed in addition, and the more water is present the greater the amount of nitrous acid formed.

The presence of free nitrogen when atmospheric air is substituted for oxygen has no appreciable effect on the reaction, since nitric acid is also produced in this case in quantitative amount if the optimum quantity of water is present. The formation of nitric acid is a time-reaction. A. McK.

**A Method for the Preparation of a Mixture of Nitric Oxide and Nitric Peroxide.** J. MATUSCHEK (*Chem. Zeit.*, 1905, 29, 31).—A mixture of nitric oxide and nitric peroxide is formed by the action of an aqueous solution of ferric chloride on sodium nitrite as represented by the equations:  $\text{Fe}_2\text{Cl}_6 + 6\text{NaNO}_2 = \text{Fe}_2(\text{NO}_2)_6 + 6\text{NaCl}$  and  $\text{Fe}_2(\text{NO}_2)_6 + 3\text{H}_2\text{O} = \text{Fe}_2(\text{OH})_6 + 3\text{NO}_2 + 3\text{NO}$ . Ferrous sulphate or ferric sulphate may be substituted for ferric chloride in the reaction. If sodium nitrite is placed under carbon disulphide and hydrated ferric chloride suspended in carbon disulphide is added, nitric oxide is alone evolved, the nitric peroxide remaining dissolved in the carbon disulphide. A. McK.

**Theory of the Action of Metals on Nitric Acid.** EDWARD DIVERS (*J. Soc. Chem. Ind.*, 1904, 23, (24), 1182—1185. Compare *Trans.*, 1883, 43, 443; Veley, *Abstr.*, 1891, i, 525; 1892, i, 410).—Silver and mercury only act on nitric acid in the presence of nitrous acid, which acts as catalyst, and molecular quantities of nitrite and nitrate are primarily produced according to the equation:  $2\text{Ag} + 2\text{HNO}_3 = \text{AgNO}_2 + \text{AgNO}_3 + \text{H}_2\text{O}$ . In this interaction, nitrous acid, nitrogen peroxide, and nitric oxide only appear as secondary products. The nitrous acid is formed by the action of nitric acid on the primary nitrite and the nitrogen peroxide by the interaction of the nitrous and nitric acids when the proportion of water is small. Nitric oxide results from the decomposition of nitrous acid when the proportion of water is large and that of nitric acid small.

The primary products of the action of zinc or tin on nitric acid are

zinc or stannous nitrate and either ammonia, nitrous oxide, or nitrogen, these three reduction products being produced independently of each other and without the formation of intermediate products. The primary formation of hydroxylamine only takes place if a stable acid, such as sulphuric or hydrochloric acid, is present. Nitrous acid or nitrite only appears as a secondary product, and nitric oxide and nitrogen peroxide are to be placed in the same category. The author thinks it possible to place all the metals in regard to their action on nitric acid in one of the above two classes. Bismuth and copper belong to the former, whilst all the strongly basic metals belong to the latter.

H. M. D.

**Action of Carbon Dioxide on the Hydroxides and Carbonates of the Metals of the Alkalis and Alkaline Earths.** PAUL N. RAIKOW (*Chem. Zeit.*, 1904, 28, 1247—1252).—Normal potassium carbonate in aqueous solution is completely converted into potassium hydrogen carbonate by an excess of carbon dioxide, no tetracarbonate being formed. The experiments made did not indicate the existence of the sesquicarbonate,  $K_4H_2(CO_3)_3$ .

When normal lithium carbonate is dissolved in water containing carbon dioxide, lithium hydrogen carbonate is probably formed; a little lithium tetracarbonate is probably also produced.

By the action of water containing carbon dioxide on normal sodium carbonate, the latter passes completely into the sodium hydrogen salt, the intermediate formation of sodium sesquicarbonate not having been observed. Similarly, in the formation of rubidium hydrogen carbonate from the normal salt, no tetracarbonate was formed; calcium, strontium, and barium carbonates respectively, under similar conditions, did not form tetracarbonates. Evidence is submitted to indicate the formation of hydrogen carbonates of lithium, calcium, strontium, and barium when an excess of carbon dioxide is passed into water containing the hydroxides or normal carbonates of those metals.

A. McK.

**Affinity of Alkali Oxides towards Various Anhydrides.** D. G. GERASSIMOFF (*Zeit. anorg. Chem.*, 1904, 42, 329—340).—The author has studied the action of sulphur trioxide on alkali tungstates and vanadates, respectively, and the action of carbon dioxide on the latter salts and also on alkali niobates, tantalates, titanates, and aluminates respectively. The avidity of alkali oxides towards carbon dioxide and sulphur trioxide respectively increases with the molecular weight of the alkali oxide. This is the case for all systems in which the following anhydrides take part:

$CO_2$  and  $SiO_2$  (Wittorf),  $CO_2$  and  $TiO_2$  (Smith),  $CO_2$  and  $WO_3$ ,  $CO_2$  and  $V_2O_5$ ,  $SO_3$  and  $WO_3$ ,  $SO_3$  and  $V_2O_5$  (the author).

By comparison of the relative affinity of the non-volatile anhydrides, it is found that in the systems where (a) sulphur trioxide and tungsten trioxide, and (b) sulphur trioxide and vanadium pentoxide are respectively concerned, vanadium pentoxide has a greater affinity than tungsten trioxide. When carbon dioxide competes with one of the anhydrides,  $V_2O_5$ ,  $Nb_2O_5$ ,  $SiO_2$ ,  $WO_3$ ,  $Al_2O_3$ ,  $TiO_2$ , and  $Ta_2O_5$ , the

sequence quoted represents the relative affinity of the latter anhydrides. The following indicates the number of molecules of carbon dioxide expelled by one molecule of the various anhydrides from two molecules of sodium carbonate at  $880^{\circ}$ , where the partial pressure of the carbon dioxide is 0.07 atmospheres:  $V_2O_5$ , 2.000;  $Nb_2O_5$ , 1.891;  $SiO_2$ , 1.310;  $WO_3$ , 1.047;  $Al_2O_3$ , 1.019;  $TiO_2$ , 0.779;  $Ta_2O_5$ , 0.727. A. McK.

**Dissociation of Ammonium Chloride in its Analytical Relations.** LUIGI SANTI (*Chem. Centr.*, 1904, ii, 1625—1626; from *Boll. Chim. Farm.*, 43, 673—681).—Iron drillings are readily attacked by a hot concentrated solution of ammonium chloride with evolution of hydrogen and ammonia and yield the compound  $FeCl_2 \cdot 2NH_4Cl$ . Magnesium powder is attacked even in the cold, forming the double salt  $MgCl_2 \cdot 2NH_4Cl$ . Calcium, zinc, cerium, manganese, and tin are also more or less attacked. On heating cobalt and nickel oxides with dry ammonium chloride, they are reduced to the metallic state, but other oxides are converted into chlorides. On boiling calcium, nickel, manganous, and ferrous oxides with a solution of ammonium chloride, they are converted into chlorides with evolution of ammonia; sesquioxides, such as ferric oxide, are not attacked. Carbonates of calcium, magnesium, copper, cobalt, and nickel are also converted into chlorides with evolution of ammonium carbonate. The sulphides of tin and antimony are attacked by heating with dry ammonium chloride, whilst the sulphide of manganese, and in a less degree that of zinc, is attacked even by solutions of ammonium chloride. Sodium thio-sulphate solution, on boiling with ammonium chloride, is decomposed according to the equation  $Na_2S_2O_3 + 2NH_4Cl = 2NaCl + H_2O + 2NH_3 + SO_2 + S$ ; if heated on a distilling apparatus, the distillate contains ammonium sulphide and polysulphide. Manganates are converted into permanganates, chromates into dichromates; the latter then even yield free chromic acid. Barium dioxide, when treated with ammonium chloride in the cold, yields hydrogen peroxide, but on heating there is an abundant formation of oxygen. Potassium persulphate yields chlorine and nitrogen and even hypochlorous acid. Glucosides (salicin, amygdalin) are practically unaffected by ammonium chloride.

L. DE K.

[Silver Dichromate.] OTTO MAYER (*Ber.*, 1904, 37, 4646).—A reply to Autenrieth's claim for priority (*Ber.*, 1904, 37, 3886).

W. A. D.

**Certain Properties of the Alloys of Silver and Cadmium.** T. KIRKE ROSE (*Proc. Roy. Soc.*, 1904, 74, 218—230).—The investigation consists in a determination of the temperatures of solidification of alloys of different composition, and in a study of their micro-structure. Evidence has been obtained of the existence of the compounds  $AgCd_3$ ,  $Ag_2Cd_3$ ,  $AgCd$ ,  $Ag_3Cd_2$ ,  $Ag_2Cd$ , and  $Ag_4Cd$ . The solid alloys containing from 0—25 per cent. of silver consist of crystals of  $AgCd_3$  set in a matrix of cadmium. Those with 25—40 per cent. consist of the compound  $Ag_2Cd_3$  set in a matrix which consists mainly of  $AgCd_3$ . The 50 per cent. alloy contains crystals of a substance rich



in silver set in a matrix consisting mainly of  $\text{AgCd}_3$ . The matrix or eutectic solidifies at  $420^\circ$ , nearly  $300^\circ$  below the freezing point of the crystals. The alloys containing 50—60 per cent. of silver consist, above  $420^\circ$ , of mixtures of two different solid solutions, one composed chiefly of the compound  $\text{AgCd}$  and the other of  $\text{Ag}_3\text{Cd}_2$ . Traces of the eutectic freezing at  $420^\circ$  are still visible. When more than 80 per cent. of silver is present, the alloys consist of a mixture of two substances at temperatures between the liquidus and solidus curves, but these unite to form a single solid solution at points on the solidus curve. The alloys containing over 80 per cent. of silver do not ordinarily undergo segregation, and are practically homogeneous and uniform in composition. They are well suited as a material for the manufacture of trial-plates.

J. C. P.

**Metallic Calcium.** KURT ARNDT (*Ber.*, 1904, **37**, 4733—4738. Compare Abstr., 1903, ii, 76).—Metallic calcium, prepared on a large scale by the electrolysis of fused calcium chloride, has been examined in detail by the author. The metal contains traces of silicon and aluminium as impurity, and when acted on by water yields almost pure hydrogen. The sp. gr. is 1.54, but rises to 1.56 on remelting owing to an increase in the percentage of silicon; when purified by distillation, the metal has a sp. gr. 1.52. Calcium melts at  $800^\circ$  and sublimes even below this temperature; the vapour reacts very vigorously with atmospheric air, and combines with oxygen and nitrogen even more readily than magnesium does.

E. F. A.

**Calcium Carbide as an Explosive in Mining Operations.** MARCEL P. S. GUÉDRAS (*Compt. rend.*, 1904, **139**, 1225—1226).—An explosive mixture of acetylene and air obtained by the action of water on calcium carbide in a limited space, and fired by means of an electric spark, can be used for blasting operations in mining, and the author describes a cartridge containing an air chamber and charged with calcium carbide (50 grams) and water separated by a membrane, which can be mechanically pierced after the cartridge is placed in the bore-hole; after five minutes, the acetylene (15 litres) mixed with the air is fired electrically.

M. A. W.

**Preparation of Barium.** ANTOINE GUNTZ (*Ann. Chim. Phys.*, 1905, [viii], **4**, 5—25).—A *résumé* of work already published (compare Abstr., 1901, ii, 385; 1902, ii, 138; 1903, ii, 369, 410).—The purest specimen of the metal obtained contained 98.35 per cent. of barium, melted at about  $850^\circ$ , and boiled at about  $1150^\circ$ .

M. A. W.

**Decomposition of Barium Nitrate by Heat.** E. BASCH (*Chem. Zeit.*, 1905, **29**, 31).—The author corroborates Gottlieb's results (Abstr., 1904, ii, 403).

A. McK.

**Decomposition of Alkaline Earth Carbonates by Alkali Chlorides in Presence of Water.** H. CANTONI and G. GOGUÉLIA (*Bull. Soc. chim.*, 1905, [iii], **33**, 13—27. Compare Abstr., 1904, ii, 334).—The influence of temperature, time, and concentration on the rate of

decomposition of barium carbonate by solutions of potassium and sodium chlorides has been investigated, and some further observations have been made on the action of sodium, potassium, and ammonium chlorides on alkaline earth carbonates at the ordinary temperature over comparatively long periods. The results, which are tabulated and graphically represented in the original, show that under all conditions the action of potassium chloride on barium carbonate is initially greater than that of sodium chloride, and increases more rapidly with increase of concentration, rise of temperature, and lapse of time, although the last factor exerts less influence than the two former in differentiating the action of the two chlorides. At the ordinary temperature, the activity of the three chlorides diminishes in the following order: ammonium, potassium, sodium; whilst the resistance of the three alkaline earth carbonates towards all three chlorides increases in the order: barium, calcium, strontium. Solutions of sodium or potassium chloride have practically no action on strontium carbonate.

T. A. H.

**Silicates. IV.** EDUARD JORDIS and E. H. KANTER (*Zeit. anorg. Chem.*, 1904, 42, 418—432. Compare Abstr., 1903, ii, 475, 542, 595).—Details are given of the preparation and analysis of the silicates of the alkaline earths previously described.

In concentrated barium hydroxide solutions, the metasilicate,  $\text{BaSiO}_3 \cdot \text{H}_2\text{O}$ , is formed. By the action of strontium hydroxide on metasilicic acid, a compound was obtained containing  $2/3\text{SrO}$  to  $1\text{SiO}_2$ ; another preparation contained the proportion  $1/3\text{SrO} : 1\text{SiO}_2$ .

By the action of calcium hydroxide on silicic acid, the metasilicate was not formed, but a compound containing  $2/3\text{CaO} : 1\text{SiO}_2$ .

The reaction between silicic acid and calcium hydroxide in presence of  $1/1$  mol. calcium chloride solution was studied. Mixtures were obtained.

The authors were unable to confirm the results of Wahl (Abstr., 1902, ii, 501), who claims to have obtained the silicate  $\text{BaSiO}_3 \cdot 6\text{H}_2\text{O}$  by the action of barium hydroxide on quartz.

A. McK.

**Separation of Glucinum from Aluminium and Iron.** G. VAN OORDT (D.R.-P. 155466).—The salts of glucinum with fatty acids dissolve in chloroform (Lacombe, Abstr., 1902, ii, 122). Glucinum may be separated from aluminium and iron by converting the mixed salts into acetates, digesting with glacial acetic acid, and extracting with chloroform, in which the pure glucinum acetate only dissolves. The treatment with glacial acetic acid is necessary in order to convert the insoluble acetate into the crystalline form, soluble in chloroform. A solution of glucinum hydroxide in hydrochloric acid is quite colourless when free from iron.

C. H. D.

**Salts and Substances for Incandescent Lighting.** HANS BUNTE (*Chem. Centr.*, 1904, ii, 1627—1628; from *J. Gasbel.*, 47, 1011—1013).—Since Eitner has found that the temperature of the Bunsen flame is itself considerably higher ( $1390$ — $1545^\circ$ ) than that of

the mantle at corresponding points ( $1265-1395^{\circ}$ ), the temperature of the latter cannot be appreciably affected by a catalytic action of the incandescent mass. According to Schmidt, the light emitted by pure thorium oxide becomes of a bluer tint as the temperature rises, whilst the nature of the light from cerium oxide is the same at all temperatures of the flame. When the proportion of cerium oxide to thorium oxide is gradually increased to 0.5 per cent., the luminosity of the mantle becomes greater, and the light of a bluer tint. Further addition of cerium oxide up to 1.5 per cent. still increases the luminosity, but the light now appears to be tinged with red. The illuminating power is decreased by larger proportions of cerium oxide, and the character of the light approaches more and more to that emitted by the pure oxide. The first effect of rise of temperature is to increase the blue rays, but when the light has attained a great intensity, all the rays are affected in practically the same way. It has been found that when mantles of different weights but of the same composition are employed, the light obtained from the heavier mantles is not so blue as that emitted by the lighter. The high temperature of the cerium oxide in the flame is partly due to its state of division and partly to the small amount present, whilst the lighting effect is primarily the result of selective radiation.

E. W. W.

**The Element Z $\delta$ .** P. É. LECOQ DE BOISBAUDRAN (*Compt. rend.*, 1904, 139, 1015—1016).—Contrary to the statement of Urbain (compare this vol., ii, 35), the author maintains that the elementary nature of Z $\delta$  was fully established by him in 1895 (compare Abstr., 1896, ii, 249), although he did not succeed in obtaining the element free from dysprosium.

M. A. W.

**Basic Alumino-silicates containing Haloids.** Z. WEYBERG (*Centr. Min.*, 1904, 729—734).—By fusing kaolin with calcium chloride, Gorgeu (Abstr., 1888, 228) obtained tetrahedra of the compound  $3\text{SiO}_2, 3\text{Al}_2\text{O}_3, 6\text{CaO}, 2\text{CaCl}_2$ . This result is confirmed, and by fusing kaolin with calcium bromide, tetrahedra with the composition  $5\text{SiO}_2, 8\text{Al}_2\text{O}_3, 12\text{CaO}, 4\text{CaBr}_2$  were obtained. In both cases, prismatic crystals of another alumino-silicate were also formed. Kaolin, when fused with a small amount of calcium bromide, gave tetragonal prisms with the composition  $\text{SiO}_2, \text{Al}_2\text{O}_3, 2\text{CaO}$ .

L. J. S.

**Products of Weathering of Silicates in Clay, Volcanic and Laterite Soils respectively.** JAKOB M. VAN BEMMELEN (*Zeit. anorg. Chem.*, 1904, 42, 265—314. Compare Abstr., 1902, ii, 70).—In soils where the products of weathering contain much alumina relatively to silica, all determinations of silica made by extracting it with hydrochloric acid are without value, since the extraction is incomplete. If, however, the soil, after treatment with hydrochloric acid, is agitated for several minutes with dilute sodium or potassium hydroxide at about  $50^{\circ}$ , the residual silicic acid is dissolved.

The ratio of alumina to silica as determined in a large number of the products of weathering of alluvial plastic clays, soils of volcanic origin, and laterite soils respectively was not constant. In ordinary



alluvial clays, the portion extracted from the disintegrated silicate by hydrochloric or by sulphuric acid indicated that the weathering had taken place in a single stage, whilst with the volcanic and laterite soils examined, various stages of weathering were recognisable, the products consisting of a mixture of silicates. The progress of the weathering was best exhibited with the laterites, the final product being in those cases hydrargillite.

The metals of the alkalis and of the alkaline earths are also present in varying amounts in the products of weathering examined, but not in sufficient amount to conclude that chemical compounds were present of the composition  $m(\text{SiO}_2), n(\text{Al}_2\text{O}_3), o(\text{MO}), p(\text{H}_2\text{O})$ , where  $m, n, o$ , and  $p$  are whole numbers. The amount of those bases present diminishes the further the weathering has proceeded.

Estimations of the amount of water in air-dried clays showed that ordinary clays contain very little water, which is lost at  $15^\circ$  when the clay is exposed to an atmosphere dried with concentrated sulphuric acid. They contain about  $2\text{H}_2\text{O}$ , which is lost at a higher temperature. The laterites examined contained more than  $2\text{H}_2\text{O}$ .

The more basic the products of weathering are, the more readily do they dissolve in hydrochloric acid.

The amount of iron oxide in various soils was also determined. This iron oxide generally contains at the ordinary temperature a little more than  $1\text{H}_2\text{O}$  and at  $100^\circ$  rather under  $1\text{H}_2\text{O}$ .

The constitution of the silicates obtained by the weathering of clays and the process of weathering itself are discussed.

Tables of the various analyses made are appended. A. McK.

**Absorption of Water by Clay.** JAKOB M. VAN BEMMELEN (*Zeit. anorg. Chem.*, 1904, 42, 314—324).—Various soils were dried at  $100^\circ$  and the percentage of water absorbed at  $15^\circ$  under varying vapour pressures was estimated. The process of absorption is reversible; the hydration and dehydration can be repeated as often as desired, and the amount of hysteresis varies with the amount of absorption.

Determinations of the rate at which the water absorbed was expelled show that it was not essentially different from the rate at which water itself evaporates under similar conditions. A. McK.

**Reduction of Manganese Oxides by Amorphous Boron. Preparation of a New Manganese Boride.** BINET DU JASSONNEIX (*Compt. rend.*, 1904, 139, 1209—1211).—Manganese oxides are readily reduced when heated with boron in an electric furnace for a few seconds with a current of 400 amperes and 100 volts; if excess of boron is used, the product consists of a mixture of manganese and a new manganese boride,  $\text{MnB}$  (compare Troost and Hauteville, *Abstr.*, 1876, i, 883), which can be isolated in the form of a crystalline powder, having a sp. gr. 6.2 at  $15^\circ$ , by the limited action of chlorine on the mixture at a dull red heat. Manganese boride burns in fluorine at the ordinary temperature, is attacked by chlorine or bromine at a red heat, whilst the action of iodine at a high temperature is only superficial; it forms a fusible borate when heated in oxygen, is not attacked by nitrogen; it slowly decomposes, cold water forming manganic hydroxide and boric acid;

dissolves in dilute hydrochloric acid, and is attacked by hydrogen chloride or hydrogen fluoride, nitric or sulphuric acids; by the action of ammonia at  $1000^{\circ}$ , a compound is obtained which contains nitrogen, is not attacked by acids, and yields manganates with evolution of ammonia on fusion with alkali carbonates. M. A. W.

**Composition of the Four Sulphides of Manganese.** JOHN C. OLSEN and W. S. RAPALJE (*J. Amer. Chem. Soc.*, 1904, 26, 1615—1622).—An investigation of the sulphides of manganese has shown that three sulphides exist, two of which, the red and the green, are anhydrous, whilst the grey sulphide contains a large proportion of water.

The pink sulphide of manganese obtained by the action of ammonium sulphide on a neutral solution of manganous chloride appears to be a mixture of the grey and red sulphides in varying proportions. The pink sulphide is not uniform in composition, and contains from 4 to 14 per cent. of free sulphur and a varying amount of water. When heated at  $360^{\circ}$  in an atmosphere of hydrogen, it is gradually converted into the green modification.

When precipitation is effected with colourless sodium sulphide, a brick red sulphide of fairly constant composition is obtained, containing about 0.75 per cent. of water. On heating the pink sulphide with hydrogen sulphide, the product obtained consists of lumps which are grey on one side and red on the other. The reason that the sulphide precipitated by sodium sulphide cannot be converted into the green modification, whilst that produced by ammonium sulphide readily undergoes this change, is probably that the latter product contains varying amounts of the grey sulphide.

The green modification is the most stable form of the sulphide, is more distinctly crystalline than the other forms, and is probably more complex in structure. E. G.

**Influence of Water Vapour on the Reduction of the Oxides of Iron by Mixtures of Carbon Monoxide and Carbon Dioxide.** OCTAVE BOUDOUARD (*Compt. rend.*, 1905, 140, 40—42).—Comparative measurements of the reduction of ferric oxide by gaseous mixtures containing equal volumes of carbon monoxide and carbon dioxide have been made, the gas being dried in one series of experiments, and saturated with water vapour at room temperature in another. The gas was passed over the ferric oxide contained in a porcelain boat, which was heated in an electric resistance furnace maintained at constant temperature, each experiment lasting one hour. The following numbers give the percentage loss of weight of the ferric oxide:

Temperature .....	400°	550°	800°	925°	1050°
Dry gas .....	0.87	4.3	4.0	5.6	6.5
Moist gas .....	0.45	3.8	2.65	4.4	6.9

The reduction effected by the dry gas is considerably greater at the lower temperatures, but there appears to be little difference in the action at about  $1000^{\circ}$ . Similar data were obtained in experiments on

the reducing action of dry and moist carbon monoxide on ferrous oxide at  $850^{\circ}$ .

The author considers that the results are in harmony with the increased economy which accompanies the use of dry air in the blast furnace.

H. M. D.

**Formation and Solubility of Double Chlorides of Iron and the Alkali Metals.** F. WILLY HINRICHSEN and EUGEN SACHSEL (*Zeit. physikal. Chem.*, 1904, 50, 81—99).—Determinations of solubility and dilatometric investigation show that in the case of sodium and ferric chlorides there is no formation of double salt between  $0^{\circ}$  and  $60^{\circ}$ . At  $21^{\circ}$ , potassium and ferric chlorides form a double salt of the composition  $\text{FeCl}_3 \cdot 2\text{KCl} \cdot \text{H}_2\text{O}$ ; if, however, the potassium chloride is in excess, mixed crystals are formed (compare Roozeboom, *Abstr.*, 1892, 1384). The temperature at which the double salt is formed from the separate salts is  $22.0$ — $22.5^{\circ}$ . No evidence could be found for the existence of the double salt,  $\text{FeCl}_3 \cdot 3\text{KCl}$ , referred to by Werner. In the case of caesium and ferric chlorides at  $21^{\circ}$ , two double salts are stable: (1) a yellow salt,  $\text{FeCl}_3 \cdot 3\text{CsCl} \cdot \text{H}_2\text{O}$ , produced when the solution contains excess of caesium chloride, (2) a red salt,  $\text{FeCl}_3 \cdot 2\text{CsCl} \cdot \text{H}_2\text{O}$ , formed in presence of excess of ferric chloride at  $39.5$ — $39.8^{\circ}$ . The authors were unable to isolate the compound  $\text{FeCl}_3 \cdot \text{CsCl} \cdot \frac{1}{2}\text{H}_2\text{O}$  described by Walden (*Abstr.*, 1895, ii, 165).

The compounds  $\text{FeCl}_3 \cdot 2\text{KCl} \cdot \text{H}_2\text{O}$  and  $\text{FeCl}_3 \cdot 2\text{CsCl} \cdot \text{H}_2\text{O}$  are in harmony with Werner's views regarding the "co-ordination number" (see *Abstr.*, 1902, ii, 554). The other caesium double salt,  $\text{FeCl}_3 \cdot 3\text{CsCl} \cdot \text{H}_2\text{O}$ , is not in harmony with these views.

Incidentally, the solubility of caesium chloride has been determined at several temperatures between  $0^{\circ}$  and  $40^{\circ}$ .

J. C. P.

**Preparation of Iron Phosphide from Calcium Phosphate.** GUSTAVE GIN (D.R.-P. 156087).—Iron phosphide may be prepared in a closed electric furnace from calcium phosphate and iron, silica being added as a flux. Iron pyrites may be employed as a reducing agent instead of the carbon hitherto used:  $4\text{Ca}_3\text{P}_2\text{O}_8 + 12\text{SiO}_2 + 5\text{FeS}_2 + 11\text{Fe} = 8\text{Fe}_2\text{P} + 12\text{CaSiO}_3 + 10\text{SO}_2$ ; or  $5\text{Ca}_3\text{P}_2\text{O}_8 + 15\text{SiO}_2 + 10\text{FeS}_2 + 5\text{Fe}_2\text{O}_3 = 10\text{Fe}_2\text{P} + 15\text{CaSiO}_3 + 20\text{SO}_2$ .

The temperature required is slightly above the melting point of iron. Several arcs, each with a tension of 25 to 30 volts, enter the same crucible, and the energy consumed amounts to 50—60 volts per sq. cm. of electrode surface. Acid calcium phosphates may be employed to economise flux. Some free phosphorus is formed by secondary reactions, and is absorbed in a chamber containing iron borings.

C. H. D.

**Alloys of Cobalt and Nickel.** W. GUERTLER and GUSTAV TAMMANN (*Zeit. anorg. Chem.*, 1904, 42, 353—362).—The authors have studied the melting-point curve of alloys of cobalt and nickel to determine whether a compound of these metals is formed, or whether both metals separate completely or incompletely from the molten mass.



When cobalt is heated, it is, like nickel, converted into a stable, non-magnetic variety.

In the curve represented, where the abscissæ indicate the composition of the mixture and the ordinates the melting points observed, the melting-point curve is represented by a straight line, the course of which is expressed by the formula  $\Delta t_0 = 0.35p$ , where  $p$  indicates the percentage of cobalt and  $\Delta t_0$  the rise of melting point. The variation of each individual melting point from this straight line amounts to only  $\pm 5^\circ$ . Nickel and cobalt accordingly separate from their molten masses in mixed crystals.

Cobalt is transformed into the non-magnetic variety at  $1150^\circ$ , whereas nickel is transformed at  $323^\circ$ . The equilibrium curve of the magnetic and non-magnetic crystal forms of nickel, cobalt, and their alloys was studied.\* The transition temperature of alloys containing 10 per cent. of cobalt rises from  $100^\circ$  to  $60^\circ$ , from which the conclusion is drawn that the concentration of the single crops of mixed crystals, which separate from the same molten mass, cannot differ from one another by more than 2 to 3 per cent. Various mixtures of nickel and cobalt were taken and the lowest temperature determined at which those mixtures became non-magnetic; the temperatures were also noted at which the mixtures again became magnetic after having been cooled.

The melting point of gold is  $1044^\circ$ .

In the concentration-temperature diagram sketched in the paper, the melting-point curve separates the field of the molten mass from the field of non-magnetic crystals, whilst the transition curve separates the latter from the field of magnetic crystals. At the temperatures of the melting-point curve, from the melting point of pure nickel,  $1484^\circ$ , to the melting point of pure cobalt,  $1528^\circ$ , the composition of the molten mass and of the mixed crystals which separate is approximately identical. At the temperatures of the transition curve, the magnetic mixed crystals are in equilibrium with the non-magnetic mixed crystals.

A. McK.

### Triamminecobalt Salts. A New Case of Hydrate Isomerism.

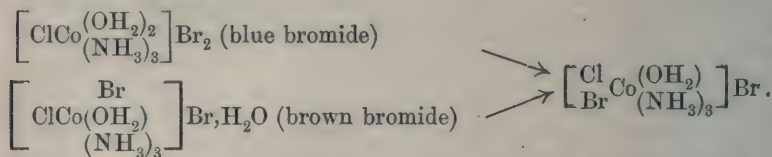
ALFRED WERNER and ADOLF GRÜN (*Ber.*, 1904, 37, 4700—4706).—*Chlorodiaquotriamminecobalt nitrate*,  $[\text{CoCl}(\text{OH}_2)_2(\text{NH}_3)_3] \cdot \text{NO}_3$ , formed by the addition of a freshly-prepared solution of chlorodiaquotriamminecobalt chloride to nitric acid of sp. gr. 1.4, separates in bluish-violet needles. The corresponding *bromide*,  $[\text{CoCl}(\text{OH}_2)_2(\text{NH}_3)_3]\text{Br}_2$ , prepared by the addition of the chloride to hydrobromic acid of sp. gr. 1.49, crystallises in dark blue needles. It is very unstable, and in a moist atmosphere forms *chlorobromo-aquotriamminecobalt bromide*,  $[\text{CoClBr}(\text{OH}_2)(\text{NH}_3)_3]\text{Br}$ , a green salt from which the original bromide may be regenerated in small amount by suspending it in alcohol and gradually adding water.

The solution of chlorodiaquotriamminecobalt bromide in water is blue, and when heated becomes red. When hydrobromic acid is added to the blue solution, the isomeric *chlorobromo-aquotriamminecobalt bromide*,  $[\text{CoClBr}(\text{OH}_2)(\text{NH}_3)_3]\text{Br} \cdot \text{H}_2\text{O}$ , separates in brown needles, even at temperatures below  $0^\circ$ . It is more stable than the blue iso-

meride, and is converted into the green chlorobromo-aquotriamminecobalt sulphate by the action of concentrated sulphuric acid. It may also be prepared by the action of hydrobromic acid on dichloro-aquotriamminecobalt chloride, when it separates in glistening, chocolate-coloured leaflets. Below  $0^{\circ}$  it forms a green solution with water, at the ordinary temperature a bluish violet, and at higher temperatures a red solution.

When chlorodiaquotriamminecobalt sulphate is triturated with fuming hydrobromic acid, anhydrous chlorobromo-aquotriamminecobalt bromide separates in olive-green crystals.

The structural relationship between the three bromides described is expressed as follows:

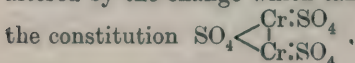


A. McK.

**Existence of a Normal Green Chromic Sulphate.** ALBERT COLSON (*Compt. rend.*, 1905, 140, 42—44).—When the green solution obtained by reducing chromic acid by means of sulphur dioxide at  $0^{\circ}$  is completely evaporated in a vacuum, an amorphous, green, hygroscopic substance of the composition  $\text{Cr}_2(\text{SO}_4)_3 \cdot 10\text{H}_2\text{O}$  is obtained. The substance appears to be a normal chromium sulphate; its aqueous solutions do not contain free sulphuric acid, and the green colour of the solutions is permanent. On addition of barium chloride, a considerable proportion of sulphuric acid is precipitated. It differs from the green sulphate described by Recoura (*Abstr.*, 1892, i, 411), for the green colour of solutions of this soon changes to violet, and barium sulphate is not precipitated on addition of barium chloride.

On boiling the aqueous solution, a change takes place which is represented by the equation  $2\text{Cr}_2(\text{SO}_4)_3 + \text{H}_2\text{O} = \text{Cr}_4\text{O}(\text{SO}_4)_5 + \text{H}_2\text{SO}_4$ .

The density of the solution is smaller after boiling, and the heat development, on addition of barium hydroxide, indicates the presence of one molecule of free acid in the boiled solution for every two molecules of the original salt. The freezing point of the solution is unaltered by the change which takes place. The salt is supposed to have



H. M. D.

**Uranyl Selenide and Potassium Chromic Selenide.** JAR. MILBAUER (*Zeit. anorg. Chem.*, 1904, 42, 450—452).—*Uranyl selenide*,  $\text{UO}_2\text{Se}$ , prepared by heating a mixture of selenium, potassium cyanide, and uranium oxide (prepared from uranyl acetate) at a low red heat, forms black, hexagonal prisms with a metallic lustre and closely resembling uranyl sulphide. When cold hydrochloric acid is added to it, hydrogen selenide is evolved and uranyl chloride produced. It is acted on very vigorously by nitric acid, selenium at first separating and then gradually oxidising.

*Potassium chromic selenide*,  $K_2Cr_2Se_4$ , prepared by heating a mixture of selenium, potassium cyanide, and chromium sesquioxide at a red heat, forms dark green, hexagonal crystals, which are readily soluble in nitric acid, but insoluble in hydrochloric acid. A. McK.

**Action of Sodium Hyposulphite on Metallic Salts. II.** OTTO BRUNCK (*Annalen*, 1904, **336**, 281—298. Compare Abstr., 1903, ii, 481).—On addition of a solution of sodium hyposulphite to solutions of metallic salts, mostly one of three reactions takes place: (a) the precipitation of a sulphide, (b) reduction to the salt of a lower oxide, or (c) complete reduction to the metal.

The following reactions with sodium hyposulphite are described.

Thallium salts, at the ordinary temperature, and indium salts, on boiling, yield the sulphides, but incompletely owing to the action of sulphurous acid formed. In a neutral solution, stannous chloride forms a precipitate of stannous hyposulphite, which dissolves in an excess of the reagent, but in presence of an excess of acid, stannous sulphide is formed; solutions of stannic chloride are completely precipitated as the sulphide. In neutral solutions, lead salts are completely precipitated as the yellow hyposulphite which changes into the black sulphide. Molybdic acid forms the sulphide in neutral solutions, whilst tungstic is reduced in slightly acid solution. Nickel and cobalt salts form the sulphides quantitatively in neutral, ammoniacal, or weak acetic acid solutions.

Titanium tetrachloride is reduced in neutral solution to the trichloride, but not in alkaline solution, as the action is reversed; similarly, chromates are reduced to chromium oxide, permanganates to manganese salts, ferric to ferrous salts, and, on heating, to ferrous sulphide, and platinic to platinous chloride with precipitation of sulphur.

Salts of palladium, selenates, and tellurates are reduced in neutral solutions completely to palladium, selenium, and tellurium respectively. Similarly, arsenic is obtained from its oxygen compounds as a brown powder which, if the reduction takes place in a strongly acid solution, contains arsenic trisulphide and sulphur.

The behaviour of salts of antimony and of bismuth is similar to that of the salts of copper.

Solutions of salts of germanium are apparently unaffected at the ordinary temperature, but, on warming, sulphur is precipitated.

G. Y.

**Inactive Thorium.** CHARLES BASKERVILLE and FRITZ ZERBAN (*J. Amer. Chem. Soc.*, 1904, **26**, 1642—1644).—It has been shown by Hofmann and Zerban (Abstr., 1903, ii, 732) that inactive thorium can be obtained from certain minerals which do not contain any radioactive constituent.

A new source of inactive thorium has been found in a rock from South America, which is of a greyish-slate colour, consists chiefly of barium carbonate containing a very small percentage of thorium, and exhibits no radioactivity.

E. G.



**Decomposition of Antimony Hydride.** ALFRED STOCK (*Zeit. physikal. Chem.*, 1904, 50, 111—112).—A continuation of a discussion with Bodenstein (see Bodenstein, *Abstr.*, 1904, ii, 245, 719; Stock and Guttman, *ibid.*, 489). J. C. P.

**Purification of Tantalum.** SIEMENS & HALSKE AKTIENGES. (D.R.-P. 155548).—Crude tantalum, obtained by reduction with sodium, always contains oxide, which may be removed by fusion in a closed exhausted electric furnace. The crude tantalum, compressed into a crucible of thoria or magnesia, forms the anode; the cathode consists of a rod of pure tantalum or silver, which is movable from the outside of the enclosing vessel. An arc is started, and is then caused to travel over the whole anode surface, when fusion to a homogeneous, non-porous mass occurs. C. H. D.

## Mineralogical Chemistry.

**Jordanite from Upper Silesia.** ARTHUR SACHS (*Centr. Min.*, 1904, 723—725).—A massive mineral, which forms with galena and blende a vein in grey dolomite in the Blei-Scharley mine at Beuthen, is proved by the following analysis to be jordanite ( $\text{Pb}_4\text{As}_2\text{S}_7$ ):

Pb.	S.	As.	Fe.	Total.
70.19	18.21	11.37	0.19	99.96

The bearing of the discovery of this arsenical mineral on the origin of the ore-deposits at Beuthen is discussed. L. J. S.

**Minerals from Arizona.** WALDEMAR LINDGREN and WILLIAM F. HILLEBRAND (*Amer. J. Sci.*, 1904, [iv], 18, 448—460).—The minerals described are from the copper deposits at Clifton and Morenci. The principal ore is massive chalcocite, which has resulted from the replacement of pyrites by means of descending solutions of cupric sulphate. A partial analysis of the chalcocite gave 96 per cent.  $\text{Cu}_2\text{S}$  and 2.4 per cent.  $\text{FeS}_2$ , the latter probably mechanically admixed.

**Coronadite.**—A black metallic mineral, not unlike psilomelane in general appearance, and intimately intermixed with quartz, is found in fairly large amount in the Coronado vein; it is named coronadite. It has a finely fibrous structure; hardness about 4; streak, black with a brownish tinge. Analysis gave:

$\text{MnO}_2$ .	$\text{MnO}$ .	$\text{PbO}$ .	$\text{ZnO}$ .	$\text{CuO}$ .	$\text{MoO}_3$ .	$\text{Al}_2\text{O}_3$ .
56.13	6.56	26.48	0.10	0.05	0.34	0.63*
$\text{Fe}_2\text{O}_3$ .	$\text{H}_2\text{O}$ .	Insol. and $\text{SiO}_2$ .	$\text{CaO}$ , $\text{MgO}$ , Alk., &c.	Total.	Sp. gr.	
1.01	1.03	7.22	0.45	100.00	5.246	

\* With a little  $\text{TiO}_2$ ,  $\text{P}_2\text{O}_5$ ,  $\text{V}_2\text{O}_5$ .

These results give the formula  $R''O, 3MnO_2$ , or, considered as a salt of a derivative of ortho-manganous acid,  $R''(Mn_3O_7)''$ . Taking into account the water (only 0·14 per cent. of which is lost below  $200^\circ$ ), the formula would be  $R_4''H_2(Mn_{12}O_{29})$ ; the water is, however, probably due to incipient alteration.

*Chrysocolla* is of common occurrence in the oxidised part of the deposits, and shows, as usual, variations in composition. Microscopical examination shows that the different concentric layers have different microcrystalline structures. The term *chrysocolla* probably includes two mineral species.

*Copper-pitch-ore*.—This occurs in association with the *chrysocolla*. It is a dark brown to black substance, with sometimes a dull, but generally a glassy to resinous, lustre. In thin sections it is opaque or translucent, the latter being optically isotropic. A partial analysis gave:

CuO.	ZnO.	MnO.	Fe <sub>2</sub> O <sub>3</sub> ,	Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> ,	Insol. in HCl (SiO <sub>2</sub> ).	Loss on ignition.	Total.
28·6	8·4	21·2	4·0		22·8	13·7*	98·7

Copper-pitch-ore is usually considered to be impure *chrysocolla*, but the material now described contains no *chrysocolla*, and it does not appear to be a mixture. It is in some respects related to *melanochalcite* (Abstr., 1903, ii, 156).

*Morencite*.—This name is given to a mineral which occurs in calcareous shale at Morenci as brown or green spreading masses. It is rendered impure by intermixed chlorite and pyrites, but more pure material is present as brownish-yellow, silky, fibrous seams intersecting the mass. Under the microscope, the minute fibres are brownish-yellow and slightly pleochroic, and extinguish parallel to their length. Analysis gave:

SiO <sub>2</sub> .	TiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.	MgO.
45·74	trace	1·98	29·68	0·83	trace	1·61	3·99

K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O (105°).	H <sub>2</sub> O (>105°).	CuO.	FeS <sub>2</sub> .	P <sub>2</sub> O <sub>5</sub> .	Total.
0·20	0·10	8·84	5·08	little	0·66	0·18	98·89

Neglecting water, a metasilicate formula,  $R_2''R_6'''(SiO_3)_{11}$ , is derived, whilst with the water as essential the ratio is that of an orthosilicate. The substance is optically well individualised, and is evidently an alteration product of some metasilicate contact-metamorphic mineral.

Other minerals described from this district are: willemite, hemimorphite, diopside, libethenite, and bronchantite, all of which are found as distinct crystals; also the rare minerals spangolite ( $H_{18}Cu_6AlClSO_{19}$ ) and gerhardtite ( $H_6Cu_4N_2O_{12}$ ). Microscopical examination of the green ores proves that bronchantite is of extremely common occurrence, mostly intergrown with malachite.

L. J. S.

**Emmonsite (?) from a New Locality.** WILLIAM F. HILLEBRAND (*Amer. J. Sci.*, 1904, [iv], 18, 433—434).—A green mammillary

\* Less O due to conversion of  $MnO_2$  to  $Mn_3O_4$ .

mineral occurring with gold and tellurite at Cripple Creek, Colorado, and resembling durdenite in appearance was found, on analysis, to approximate to emmonsite in composition. The cleavage and optical characters are also in general agreement with those previously described for emmonsite. The following results (22.44 per cent. gangue, mainly quartz, deducted) give the ratios  $\text{TeO}_2 : \text{Fe}_2\text{O}_3 : \text{H}_2\text{O} = 3.16 : 1.00 : 1.77$ .

$\text{TeO}_2$ .	Se.	$\text{Fe}_2\text{O}_3$ .	$\text{H}_2\text{O}$ at $100^\circ$ .	$\text{H}_2\text{O}$ above $100^\circ$ .
70.71	nil	22.76	0.21	4.54
$\text{P}_2\text{O}_5$ .	$\text{Al}_2\text{O}_3$ .	$\text{SiO}_2$ , &c.	Total.	Sp. gr.
0.34	0.56	0.88	100.00	4.53

L. J. S.

**The Sodalite Series.** Z. WEYBERG (*Centr. Min.*, 1904, 727—729).—This is a continuation of the work of Lemberg, Thugutt (*Abstr.*, 1895, ii, 358), and Morozewicz (*Abstr.*, 1899, ii, 764) on derivatives of the group  $\text{Na}_2\text{Al}_2\text{Si}_2\text{O}_8$ . A mixture of silica, alumina, and soda in the proportions  $\text{Na}_2\text{Al}_2\text{Si}_2\text{O}_8$  was fused with sodium chromate; there was obtained a yellow, crystalline powder of isotropic grains and cubes with the composition  $7\text{SiO}_2, 4\text{Al}_2\text{O}_3, 5\text{Na}_2\text{O}, \text{CrO}_3$   
 $(= 7\text{Na}_2\text{Al}_2\text{Si}_2\text{O}_8, \text{Na}_2\text{Al}_2\text{O}_4, 2\text{Na}_2\text{CrO}_4)$ .

L. J. S.

## Physiological Chemistry.

**Changes in the Viscosity of the Blood produced by Alcohol.** RUSSELL BURTON-OPITZ (*J. Physiol.*, 1904, 32, 8—17).—The viscosity values were obtained by Hürthle's method. The addition of 0.7 per cent. solution of sodium chloride to blood causes an immediate and distinct decrease of viscosity, whilst equal amounts of distilled water render the blood slightly more viscous. Alcohol intravenously injected or absorbed from the alimentary canal increases the viscosity of the blood; the effect lasts from 30 to 45 minutes. The sp. gr. and viscosity vary in the same manner. The experiments were made on dogs.

W. D. H.

**Nuclei of Birds' Red Corpuscles.** D. ACKERMANN (*Zeit. physiol. Chem.*, 1904, 43, 299—304).—A mass of nuclei of the birds' red corpuscles was obtained by a method of washing with saline solution, then with water to remove hæmoglobin, and centrifugalising. Lecithin and cholesterol were removed by alcohol, and phosphorus and nitrogen estimated in the residue; from the numbers obtained, it is calculated that the nuclei consist of 42 per cent. of nucleic acid and 58 per cent. of histon.

W. D. H.



**Gaseous Metabolism of the Kidney.** JOSEPH BARCROFT and THOMAS G. BRODIE (*J. Physiol.*, 1904, 32, 18—27).—The experiments were made on dogs which had been subjected to evisceration, an operation they survive about eight hours. Diuresis, usually produced by injection of urea, is accompanied by a large increase of oxygen absorption in the kidney, but that increase is not in proportion to the diuresis produced. In only one experiment was there any increase in the carbon dioxide given out. There is no definite relation between the oxygen absorbed and the carbon dioxide given out at any one time. The volume of the latter is often in excess of the former, especially at the commencement of an experiment, before diuresis has been set up. The amount of the two gases exchanged during diuresis varies from 0.002 to 0.281 c.c. per gram of kidney substance per minute. There is no necessary accompaniment of increase of blood flow, and this is never in proportion to the acceleration of the urine flow. The blood gases were estimated by the pump and by the Barcroft-Haldane method.

W. D. H.

**Nutritive Value of Proteid Decomposition Products. I.** W. CRONHEIM (*Pflüger's Archiv*, 1904, 106, 17—42).—The experiments were made on men and dogs, and compare the work of the digestive tract during feeding on flesh and somatose. The latter can be given in large quantities (30 grams) to men without producing intestinal irritation; this quantity necessitates a smaller digestive activity than flesh containing an equivalent amount of nitrogen.

W. D. H.

**Sulphur and Phosphorus Metabolism on an Abundant Proteid Diet.** KARL BORNSTEIN (*Pflüger's Archiv*, 1904, 106, 66—79).—The higher the percentage of neutral phosphorus and sulphur in the urine, the smaller is the oxidative power of the organism. The experiments recorded lend support to the doctrine that an abundant proteid diet improves the cellular activities of the organism.

W. D. H.

**Peptic Digestion Products of Plasteins.** JOSEPH GROSSMANN (*Beitr. chem. Physiol. Path.*, 1905, 6, 191—205).—The addition of a peptic digest of plasteins to the finely subdivided mucous membrane of stomach or intestine (obtained from fed or hungry dogs) leads at 38° to 40° to a disappearance of non-coagulable and a corresponding appearance of coagulable proteid material. This is a proof that the mucous membrane contains not only proteolytic enzymes, but agents which act in the opposite direction.

W. D. H.

**Formation of Sugar from Proteid.** HUGO LÜTHJE (*Pflüger's Archiv*, 1904, 106, 160—167).—The pancreas was removed from a dog and the animal observed for about a month, during which time it was kept on a proteid diet (mainly nutrose); the total sugar in the urine was far too large to be accounted for by that in the food, or present as glycogen in the body: the remainder must therefore have been derived from proteid.

W. D. H.

**Pancreatic Diabetes.** EDUARD PFLÜGER (*Pflüger's Archiv*, 1904, 106, 168—172).—A commentary on Lühje's work (see preceding abstract), in which it is shown that a large amount of the excreted sugar cannot have had a carbohydrate origin; the figures work out rather differently from those calculated by Lühje, but the main conclusion is corroborated. The author holds that the sugar excreted as the result of feeding on proteids (and the same is true for feeding on alanine, glycine, asparagine, &c.) is due to an indirect action, analogous to the way in which ammonium carbonate will cause an increase in the hepatic glycogen, and, further, that the sugar attributed to proteid decomposition really originates from fat. In many diabetics there is no increased nitrogen excretion.

W. D. H.

**Are Proteolytic and Rennetic Ferments Identical?** IVAR BANG (*Zeit. physiol. Chem.*, 1904, 43, 358—360).—Pawloff has advanced the view that the rennet action of gastric juice is a property of pepsin, and holds similar views regarding other rennetic ferments. In the present communication, a number of weighty arguments are adduced to show that this cannot be the case.

W. D. H.

**The Lymph-flow from the Pancreas.** F. A. BAINBRIDGE (*Brit. Med. J.*, 1904, ii, 1742—1744; *J. Physiol.*, 1904, 32, 1—8).—The intravascular injection of secretin or extract of ileum in dogs causes an increased flow of lymph from the thoracic duct. This has also been shown to be the case by Falloise (*Bull. Acad. Roy. Belg.*, 1902, No. 12, p. 945). After ligation of the portal lymphatics, secretin still causes an increased flow of lymph, whereas ileum extract has no effect. The increased flow of lymph is closely related to the secretion of pancreatic juice; it is derived entirely from the pancreas, and is probably formed as a result of metabolic changes occurring in the pancreas during the secretion of the juice. It is produced by secretin, and not by the depressor substance in the extract.

W. D. H.

**Influence of Alkalis on the Growth of Bone.** HANS ARON (*Pflüger's Archiv*, 1904, 106, 91—92).—A preliminary account of experiments to show the importance of sodium and potassium salts in the food on the growth of bone.

W. D. H.

**Condition of Water in the Tissues.** R. DU BOIS REYMOND (*Chem. Centr.*, 1904, ii, 1661—1662; from *Verh. Ges. Deut. Nkf. Ärzte*, 1903, II, (2), 437—440).—The swelling which certain tissues undergo with water is regarded not as due to mechanical forces, but more probably to chemical union. This is supported by experiments with dried albumin.

W. D. H.

**Universal Presence of Erepsin in Animal Tissues.** HORACE M. VERNON (*J. Physiol.*, 1904, 32, 33—50).—Erepsin was obtained in glycerol extracts of a large number of tissues of both vertebrate and invertebrate animals; least was obtained from invertebrates, and most from mammals. The kidney is richest in the enzyme; then follow intestinal mucous membrane, pancreas, spleen, and liver; then, after a

large drop, heart muscle; whilst skeletal muscle and brain tissue are poorest. The relative amount in the tissues is constant and not a matter of chance, and must be related to their function. The lower the animal in the scale of evolution, the less are its tissue erepsins influenced by the reaction of medium; in mammals, an alkaline medium is most and an acid medium least efficacious. To some extent the tissue erepsins are specific, the intestinal extract, for instance, having relatively much more action on partially hydrolysed peptones than kidney and liver extracts,

W. D. H.

**Chemical Changes produced in Flesh by Fungi.** P. W. BUTJAGIN (*Arch. Hygiene*, 1905, 52, 1—21).—During the development of *Penicillium glaucum* and *Aspergillus niger* in flesh, the amount of water increases, the absolute amount of nitrogen diminishes, and the nitrogenous compounds soluble in water increase; the ethereal extract is lessened, especially in early stages, and the amount of extractives increases; the alkalinity rises, as also does the amount of volatile acids. The fungi appear to secrete enzymes which are proteolytic and lipolytic. Some quantitative differences between the actions of the two fungi are noted, and on the whole *P. glaucum* destroys the constituents of flesh more rapidly.

W. D. H.

**Tyrosinase in the Skins of some Pigmented Vertebrates.** FLORENCE M. DURHAM (*Proc. Roy. Soc.*, 1904, 74, 310—313).—An aqueous extract of the skins of rabbits, rats, guinea-pigs, and chickens acts on tyrosine and produces a pigmented substance. This suggests the presence of a tyrosinase in the skins of these animals. The action takes place most readily at 37° and is destroyed by boiling; the presence of an activating substance like ferrous sulphate is necessary to start it. Black substances are obtained when animals with black pigment in their skins are used, and yellow substances when the skin contains the yellow pigment. These coloured substances are soluble in alkalis, but insoluble in acids.

W. D. H.

**Fat in Milk.** WILHELM CASPARI (*Chem. Centr.*, 1904, ii, 1664—1665; from *Zeit. Biol.*, 46, 277—279).—Polemical. The question raised is the origin of the milk fat from the fat of the food. The casein used by some observers was not absolutely free from fat. Iodocasein and iodoalbumin freed from fat cause no trace of iodised fat in the milk.

W. D. H.

**Functions of Thyroid and Parathyroid Glands.** SWALE VINCENT and W. A. JOLLY (*J. Physiol.*, 1904, 32, 65—86).—Removal of both thyroid and parathyroid does not necessarily cause death; but fatal results, when they do occur, are due to the absence of these glands. Great variations obtain in the animal kingdom in this matter. Rats and guinea-pigs do not suffer at all. Monkeys show transient nervous symptoms. Dogs and cats suffer severely and usually die. In foxes, the symptoms are of rapid onset, and death occurs early. No symptoms of myxedema were ever observed; this disease is therefore due to causes more complex than thyroid insufficiency. In young



animals, however, thyroid extirpation causes temporary cessation of growth. When the thyroid is removed, the parathyroids appear capable of replacing it to some extent, and their histological structure changes accordingly.

W. D. H.

**Elimination of Urea in Healthy Subjects.** HENRI LABBÉ and E. MORCHOISNE (*Compt. rend.*, 1904, 139, 941—943).—That the amount of urea depends on the amount of proteid ingested is supported by the experiments recorded on a number of healthy people on the same diet. The amount in all was approximately identical.

W. D. H.

**Organic Phosphorus in Urine.** DOUGLAS SYMMERS (*J. Pathol. Bacteriol.*, 1905, 10, 159—172).—The estimation of inorganic phosphates is not a true index of phosphorus metabolism; in various pathological conditions, the phosphoric acid in organic combination may be frequently 25—50 per cent. of the total. The excretion of organic phosphorus is to a certain extent rhythmical. The amount is pronounced in lymphatic leucæmia, and especially in degenerative nervous diseases. It may be due to an increase in endogenous phosphorised katabolites, or may be an expression of lessened oxidation which normally would give inorganic phosphates as the end-products. The theory that it originates from bone is dismissed, for in extensive disease of bone like osteomalacia the output of phosphoric acid is not increased.

W. D. H.

**Substances Soluble in Ether in Human Fæces.** FELIX OEFELE (*Chem. Centr.*, 1904, ii, 1664; from *Ber. Deut. pharm. Ges.*, 14, 355—371).—Analytical numbers are given for preformed neutral fat, fatty acids, lecithin, &c., in the fæces. A part is unsaponifiable. Great variations occur in health.

W. D. H.

**Pernicious Anæmia.** G. LOVELL GULLAND and ALEXANDER GOODALL (*J. Pathol. Bacteriol.*, 1905, 10, 125—144).—This is a megaloblastic anæmia; the blood cells are abnormally vulnerable; a toxin is produced which does not always originate in the intestine. The large red corpuscles produced in the marrow fall a ready prey to endothelial cells and leucocytes. In some cases this is congenital. The accumulation of iron in the liver is the usual result of excessive blood destruction, and does not necessarily mean that the actual destruction occurs altogether in that organ.

W. D. H.

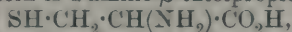
**Acid Dyscrasia.** ALEXANDRE DESGREZ and J. ADLER (*Compt. rend.*, 1904, 139, 944—945. Compare Abstr., 1904, ii, 193).—An acid dyscrasia can be produced in guinea-pigs by repeated subcutaneous injections of hydrochloric acid. In this condition, there are (1) a preponderating disintegration of the proteids rich in sulphur, (2) a lessening of the urine formed, and (3) a considerable increase of nitrogenous metabolites in the tissues. The conditions are similar to those noted in skin diseases.

W. D. H.

**Influence of Fever on the Reducing Action of the Organism.** C. A. HERTER (*Amer. J. Physiol.*, 1904, 12, 457—465).—The temperature of rabbits was raised either by superheating or infection with hog-cholera. Elevation of temperature accelerates the reduction of methylene-blue by various types of cells. The differences of colour are especially striking in brain, skeletal muscles, heart, spleen, pancreas, and liver. A method for measuring the reaction-velocity of reduction was also devised. W. D. H.

**Production and Inhibition of Glycosuria in Rabbits by Salts.** MARTIN H. FISCHER (*Pflüger's Archiv*, 1904, 106, 80—83).—Intravenous injection of sodium chloride and other sodium salts in rabbits produces glycosuria, which is inhibited by calcium chloride. This is most readily produced if the injection is made towards the brain; the salt probably produces an osmotic change which affects the "diabetes centre." Cutting the splanchnic nerves prevents it. Lithium, strontium, and potassium salts also produce similar glycosuria; ammonium salts do so also in large doses, but here hæmoglobinuria also occurs. Calcium and magnesium salts kill the animal before any sugar can pass into the urine. Non-electrolytes such as urea, alcohol, and glycerol are inactive. W. D. H.

**Cystinuria.** I. ADOLF LOEWY and CARL NEUBERG (*Zeit. physiol. Chem.*, 1904, 43, 338—354).—Friedmann and Neuberg have shown that the cystin of urinary calculi (calculus-cystein) is not identical, but isomeric, with that obtained from the decomposition of horn (protein-cystin). Protein-cystein is  $\alpha$ -amino- $\beta$ -thiolpropionic acid,



whereas calculus-cystein is  $\beta$ -amino- $\alpha$ -thiolpropionic acid,



The special interest of this isomerism arises from the fact that this is one of the rare instances of a  $\beta$ -amino-acid arising during animal metabolism. Tryptophan is another instance (indole- $\beta$ -aminopropionic acid, Ellinger), and some of Levene's amino-acids do not belong to the  $\alpha$ -series. A patient æt. 18, excreting 0.5 gram of cystin daily, came under the authors' notice, and, contrary to expectation, this was protein-cystin. Acting on the supposition that the case was not merely one of anomalous proteid metabolism, but one in which there was a general breakdown of amino-acid metabolism, the urine was searched for other amino-acids, but without success; diamines were also absent. The anomalous nature of the metabolism was, however, shown when amino-acids were administered by the mouth. Tyrosine, leucine, and aspartic acid, instead of being broken down in the body, were excreted in the urine almost quantitatively; the same was true for protein-cystin (given in 6-gram doses), whereas a normal man will burn 8 grams with the formation of sulphates and thiosulphates. On the other hand, calculus-cystin was completely burnt with a corresponding increase in sulphates and neutral sulphur. After feeding on lysine, cadaverine (pentamethylenediamine) appeared in the urine, and putrescine (tetramethylenediamine) appeared after the administration of arginine. There is here a direct fermentative splitting off of carbon dioxide, the first time

it has been shown to occur *in vivo*. Whether this is brought about by enzymes or by intestinal bacteria it is impossible to say, for the patient would not permit subcutaneous injections, but the discovery of arginine by Kossel and Dakin would appear to point to an enzyme, for ornithine, by loss of carbon dioxide, would yield tetramethylene-diamine.

The interest of the case is this: if proteids are normally broken up in the alimentary canal into simple crystalline cleavage products, why did not this patient excrete them unchanged, as he did when they were given by the mouth? This tells against the theory of complete proteolytic breakdown in the intestine. It may be that cystin is specially loosely combined in the proteid molecule. Further experiments with polypeptides, proteoses, and peptones are in progress.

W. D. H.

**Oxaluria.** FRIEDRICH KUTSCHER and MARTIN SCHENK (*Zeit. physiol. Chem.*, 1904, 43, 337).—By oxidation of gelatin with calcium permanganate, important amounts of oxamic acid are obtained. The mother substance of this must be glycine. Proteids poor in the glycine radicle, such as casein and pseudomucin, yield little or none. On the clinical side, Lommel (*Deutsch. Arch. klin. Med.*, 1899) showed that feeding with gelatin produced oxaluria. Oxidation in the body doubtless caused the appearance of oxamic acid, and this is broken down with the formation of oxalic acid and ammonia.

W. D. H.

**Elimination of Sulphur and Phosphorus, Demineralisation of the Organism, and Size of the Molecule Elaborated in Skin Diseases.** ALEXANDRE DESGREZ and J. AYRIGNAC (*Compt. rend.*, 1904, 139, 900—901).—The examination of the urine in cases of skin disease shows that the disintegration is most marked in those proteids which are rich in sulphur. What is termed demineralisation of the organism was higher than normal in 56 per cent. of the cases.

W. D. H.

**Tetanus and Quinine.** E. VINCENT (*Ann. Inst. Pasteur*, 1904, 18, 748—760).—Observers have not infrequently described tetanus as a sequel to injections of quinine given for malaria. In these days of antiseptics, this cannot be due to infection from dirty instruments. Quinine hydrochloride kills the tetanus bacillus, and so cannot favour its development. The fatal dose of quinine varies a good deal in different animals; this had to be determined before the next experiments were performed; these consisted in subcutaneously administering quinine either with or subsequently to a subcutaneous dose of tetanus bacilli, and the remarkable fact was elicited that these animals quickly died, whereas those who received only one of the two substances injected recovered. With the injection of both, the bacilli multiply more rapidly and pass more into other tissues. Quinine given by other channels does not act thus. Its action is attributed to its harmful action on leucocytes. If quinine is given subcutaneously for malaria, and the patient has cutaneous excoriations, it is wise to administer also antitetanic serum.

W. D. H.



**Action of Chloroform on the Heart and Arteries.** EDWARD A. SCHÄFER and HERBERT J. J. SCHARLIEB (*Trans. Roy. Soc. Edin.*, 1904, 41, Part II, (No. 12), 311—341. Compare Abstr., 1903, ii, 437).—By perfusing the vessels of a frog with blood or saline solution containing a high percentage of chloroform (1 to 5 grams per litre), the blood-vessels are directly constricted; with more dilute mixtures, the effect is less pronounced, but dilatation is never obtained. In experiments on mammals, the same main effect is produced, even with dilute solutions, except in the kidney, where the vessels are dilated. The effect is one on muscular tissue, not on vaso-motor nerve-endings, for apocodeine does not abolish the effect, as it does that of adrenaline. The fall of blood pressure seen is of cardiac origin, the depressant effect on the heart being more than sufficient to counterbalance constriction of peripheral vessels. The effect on the heart resembles that of vagus excitation, except that the arrest is more permanent. With the arrest of the circulation, the respiratory centre also fails secondarily. During light anæsthesia, vagus excitation easily causes arrest of the heart, which, however, soon escapes from vagus control, but in deep anæsthesia the effect is more pronounced.

Quite small doses of atropine (0.00002 gram per kilo. of body weight in the dog given subcutaneously) prevent the effect of vagus excitation on the heart, and this lasts for three hours. The precaution of administering a dose of atropine before chloroform anæsthesia in man should never be omitted, even although it will not prevent death when an overdose of chloroform produces paralysis of respiration and complete "paralytic dilatation" of the heart. The cardiac arrest sometimes noticed in the initial stage of anæsthesia is a reflex vagus effect; this is prevented by atropine. The paralytic dilatation that occurs in later stages when too much chloroform is given is due to action in the neuro-muscular inhibitory end-apparatus rather than in the muscle itself. The heart is then entirely inexcitable, and respiration fails first. This final effect on the heart is not antagonised by atropine, nor is adrenaline of any avail as a rule. The addition of small quantities of ammonia vapour or ammoniated alcohol to the chloroform inhaled in cases where danger is signalled is strikingly beneficial, and alcohol vapour itself without the ammonia is nearly as good. The alcohol in A.C.E. mixture is needlessly excessive. The post-mortem appearances after death from chloroform inhalation are very similar to those seen in asphyxia due to deprivation of air, or by drowning, even although there may be no true asphyxia and a free supply of air by artificial perfusion. W. D. H.

**Action of Monatomic Alcohols on Simple Organs.** PAUL GRÜTZNER and H. BREYER (*Chem. Centr.*, 1904, ii, 1665; from *Verh. Ges. Deut. Nf. Ärzte*, 1903, II, (2), 443).—These alcohols act harmfully on cilia, the higher ones more intensely and rapidly. W. D. H.

**Relations between the Chemical Constitution and Physiological Action of some Ammonium Bases.** ERNST SCHMIDT (*Arch. Pharm.*, 1904, 242, 705—714. Compare especially Abstr., 1892, 905, and this vol., i, 23; also, for the preparation of the substances in

question, Abstr., 1892, 806, 949, 950; 1894, i, 433; 1901, i, 443; this vol., i, 23).—A *résumé* of matter already published. C. F. B.

**Betaine.** ALOIS VELICH (*Zeit. Zuckerind. Böhm.*, 1904, 29, 14—25).—The author finds that pure betaine has no poisonous action, the effects noticed by Waller and Lowton (Abstr., 1904, ii, 65) being due to the insufficient neutralisation of the betaine hydrochloride employed. Even after very strong doses, the author is unable to find any diminution of the blood pressure or retardation of the pulse.

T. H. P.

**Effect of Adrenaline on Excretion of Sugar and Nitrogen in Birds.** DIARMID NOËL PATON (*J. Physiol.*, 1904, 32, 59—64).—When adrenaline is administered subcutaneously, it produces glycosuria in birds as in mammals. It does not act through the pancreas. It causes a decrease in the proportion of nitrogen elaborated into uric acid, an increase of the nitrogen present as ammonia, and probably in that in urea also.

W. D. H.

**Selective Action of Cocaine on Nerve-fibres.** WALTER E. DIXON (*J. Physiol.*, 1904, 32, 87—94).—Cocaine locally applied to nerve-fibres picks out and paralyses some before others: sensory before motor, afferent before efferent vagal fibres, vaso-constrictors before vaso-dilators, and broncho-constrictors before broncho-dilators.

It is suggested that the local application of cocaine to the vagi may be a means of combating death during early chloroform narcosis. Drugs which attack the central nervous system almost invariably attack the sensory cells and fibres before the motor. There is no reason to suppose that cocaine has a specific action on sensory nerve-endings.

W. D. H.

**Physiological Action of Azoimide.** LETCHWORTH SMITH and C. G. L. WOLF (*J. Medical Research*, 1904, 12, 451—474).—Azoimide is a very powerful protoplasmic poison; the effect of small doses is almost instantaneous death. It is almost impossible to determine the details of its action, unless very small doses are employed, and the use of the sodium compound minimises to some extent the danger and unpleasant symptoms which the observers experience. The experiments made on frogs and mammals show that the action in the main resembles that of hydrocyanic acid. Muscle and nerve are simultaneously paralysed after a preliminary stage of increased excitability. The respiratory centre is similarly first excited, and then paralysed. The fall of blood pressure seen is primarily due to vascular dilatation, especially in viscera other than intestine and kidney. It forms a compound with methæmoglobin resembling that formed by hydrocyanic acid, but the existence of a compound with hæmatin or hæmoglobin was not made out. Introduction of a phenyl radicle lessens its action.

W. D. H.

**The Toxic and Anti-toxic Action of Salts.** ALBERT P. MATHEWS (*Amer. J. Physiol.*, 1904, 12, 419—443).—The valence of an

ion is of little or no importance in determining its anti-toxic action. Attention should therefore be directed to its other properties, potential weight, velocity, and volume. W. D. H.

**Action of Calcium Permanganate on Alkaloids.** G. BAUDRAN (*Compt. rend.*, 1904, 139, 1000—1002).—If strychnine sulphate or hydrochloride is treated at 37° with a 5 per cent. solution of calcium permanganate, a product is obtained which, when mixed with strychnine, annihilates its poisonous effects. Similar results were obtained with morphine and aconitine. The products all contain manganese. W. D. H.

**Chemical Combination and Toxic Action as Exemplified in Hæmolytic Sera.** ROBERT MUIR and CARL H. BROWNING (*Proc. Roy. Soc.*, 1904, 74, 298—309).—In the action of a complement there are two distinct factors: (1) the power of chemical combination, and (2) toxic action, which correspond to Ehrlich's haptophore and zymotoxic groups. Deficiency in action does not necessarily imply absence of the first factor, but may be due to the non-sensitiveness of the tissue molecule to the second group. In testing the corpuscles of an animal, it is found that very large doses of both complement and immune-substance are necessary if serum from the same species of animal is used, and want of sensitiveness is especially noticeable in connection with the zymotoxic group. In some cases there is also deficiency in the combining power of the complement with the receptors of red corpuscles. The differences of dosage of the immune-substance with different complements, and also of various complements, do not appear to be due to multiplicity of immune-substances. W. D. H.

**Plurality of Cytolysins in Snake Venom.** SIMON FLEXNER and HIDEYO NOGUCHI (*J. Pathol. Bacteriol.*, 1905, 10, 111—124).—Snake venoms from different sources contain solvents for numerous cells other than blood corpuscles. This is due to a number of distinct solvents, and depends on the interaction of amboceptors and complements. The latter are contained within the affected cell. W. D. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**New Method for the Purification of Water Supplies.** GEORGE T. MOORE (*Amer. J. Pharm.*, 1904, 76, 553—564).—The treatment consists in adding copper sulphate to the water in the proportion of 1 to 5,000,000. By this means, the growth of algæ is prevented, sewage bacteria are destroyed, and the total number of bacteria is reduced by at least 95 per cent. Over 50 public water supplies in the United States are now being treated with copper sulphate, the reservoirs concerned holding from a few to hundreds of



millions of gallons. The quantity of copper added to the water is considered to be too small to have the slightest effect on the health of the consumers, even if copper itself be injurious, which is doubtful.

W. P. S.

**The Copper Treatment of Water.** HENRY KRAEMER (*Amer. J. Pharm.*, 1904, 76, 574—579).—The results are given of experiments carried out for the purpose of testing the efficiency of copper in reducing the number of micro-organisms in drinking-water. The conclusions arrived at are : (1) that intestinal bacteria, such as *Bacillus coli* and *B. typhosus*, are completely destroyed by placing clean copper-foil in the water containing them ; (2) that the effects of colloidal copper and copper sulphate in the purification of drinking-water are, in a quantitative sense, much like filtration, only the organisms are completely destroyed ; (3) that, pending the introduction of the copper treatment on a large scale, drinking-water may be purified by the use of strips of copper foil, 3·5 inches square to each quart of water ; after being allowed to act for 8 hours at the ordinary temperature, the water is then drawn off or the strips are removed.

W. P. S.

**Hydrogen Sulphide Microbes in Mineral Waters.** N. GOSLINGS (*Centr. Bakt. Par.*, 1904, ii, 13, 385—394).—Passugger water was found to contain sulphate-reducing bacteria, perhaps Beijerinck's *Microspira desulfuricans* ; but attempts to obtain pure cultures of the hydrogen sulphide microbe were unsuccessful.

N. H. J. M.

**Is Hydrogen Peroxide suitable for Sterilising Milk?** P. GORDAN (*Centr. Bakt. Par.*, 1904, ii, 13, 716—728).—Small amounts of hydrogen peroxide, as employed by Budde (*Milch-Zeit.*, 1903, No. 44), have practically no sterilising action on milk. Larger quantities, which impart an unpleasant taste to the milk, have a temporarily retarding effect on the growth of the bacteria. Complete sterilisation is only effected by amounts three times as great as those employed by Budde, and the milk is then useless for human consumption. The process is, besides, troublesome and rather expensive.

N. H. J. M.

**Production of Fat from Proteid by *Bacillus pyocyaneus*.** S. P. BEEBE and B. H. BUXTON (*Amer. J. Physiol.*, 1904, 12, 466—470).—In growths of *Bacillus pyocyaneus* in proteid media, a pellicle of fat is formed ; this is partly crystalline, and various constants were determined. It is probable that the fat is formed in part by oxidation of albumoses apart from any carbohydrate nucleus they may contain.

W. D. H.

**Respiration and Fermentation of Mould Fungi in Rose Cultures.** T. KRASNOSSELSKY (*Centr. Bakt. Par.*, 1904, ii, 13, 673—687).—*Mucor spinosus* and *Aspergillus niger* give in air, on substrata capable or incapable of fermentation, similar curves of elimination of carbon dioxide. In absence of oxygen they behave

differently on fermentable substrata, the carbon dioxide curve showing that fermentation takes place with *Mucor spinosus*, but not with *Aspergillus*.

*Mucor spinosus*, on non-fermenting substrata, and *Aspergillus*, on both substrata, give off less carbon dioxide in hydrogen than in air. Sometimes only traces of carbon dioxide are produced. Under these conditions, they can live a long time (67 and 141 hours respectively), and become capable of further development when air is admitted. The amount of carbon dioxide then rapidly increases and may often exceed the amount produced under normal conditions of aëration. This vigorous production of carbon dioxide does not, however, last long. The results are similar to those observed by Palladin with *Chloro<sup>2</sup>thecium saccharophilum*.

N. H. J. M.

**Comparative Production of Alcohol and Carbon Dioxide during Fermentation.** LÉON LINDET and P. MARSAIS (*Compt. rend.*, 1904, 139, 1223—1225).—It has been established by Pasteur, by Gay-Lussac, and by Buchner and Hahn that the ratio between the alcohol and carbon dioxide in the final products of fermentation is sensibly equal to unity; the authors find, however, that if the alcohol and carbon dioxide are estimated during the process of fermentation, the ratio, which is greater than unity at the early stages of the process, diminishes towards unity as the reaction proceeds. The experiments were conducted on three equal quantities of sterilised grape extract containing the same quantities of the same yeast, and the alcohol and carbon dioxide estimated at three different stages of the reaction. Further experiments showed that the ratio between the alcohol and carbon dioxide is not appreciably influenced by changes in the temperature or in the acidity of the sucrose extract. The initial preponderance of the alcohol over the carbon dioxide is connected with the growth of the yeast, which is more rapid at the early stages of the fermentation.

M. A. W.

**The Alcoholic Ferment of Yeast Juice.** ARTHUR HARDEN and WILLIAM J. YOUNG (*Proc. Physiol. Soc.*, Nov., 1904, 1—2; *J. Physiol.*, 32).—The alcoholic fermentation of dextrose by yeast juice is greatly increased (doubled) by the addition of boiled and filtered yeast juice, although the latter fluid is itself incapable of causing the fermentation. This may be due to an increase in the activity of the alcoholic ferment or to a decrease in that of the proteolytic enzyme (endotryptase); the former, however, is the more important action of the two. The substance in the boiled juice responsible for this action, or "co-ferment," is not affected by boiling; it is dialysable and precipitated by 75 per cent. alcohol. By filtration through a gelatin filter, the enzyme and its co-ferment can be separated; neither by itself produces fermentation; a mixture of the two is equal in power to the original juice. No co-ferment of endotryptase was discovered.

W. D. H.

**Nitrification and Denitrification in Arable Soil.** F. LÖHNIS (*Centr. Bakt. Par.*, 1904, ii, 13, 706—715).—Denitrification in soils can only be inconsiderable owing to the amount of air present. Pro-

duction of proteids is also inconsiderable owing to the absence, as a rule, of sufficient readily assimilable organic matter. Nitrification generally greatly exceeds the antagonistic processes, because the conditions usually present in soils are more favourable to nitrifying organisms than to the others. All three processes may, however, under certain conditions be going on simultaneously.

N. H. J. M.

**Assimilation of Free Nitrogen by Bacteria.** GEORGE S. FRAPS (*Rep. of Chemist, Agric. Exper. Stat. N.C.*, 1902—1903, 40—44).—The results of preliminary experiments on soil bacteria which assimilate free nitrogen without symbiosis indicated that the greatest activity is in alkaline solutions containing glucose (2), potassium phosphate (0·2), sodium chloride (0·2), magnesium sulphate (0·2), and ferric chloride (0·01 per cent.), calcium carbonate (0·5 per cent.) being present. Less activity was observed when magnesium sulphate was omitted, and much less in neutral solutions containing mannitol, potassium sulphate, ferric chloride, and soil.

Bacteria may possibly exist which are more active in a neutral medium. Substitution of glucose by starch did not increase the assimilation of nitrogen. Nearly all the nitrogen was fixed in the first week of the experiment, a small amount being fixed in the second week.

N. H. J. M.

**Nitrification of Different Fertilisers.** W. A. WITHERS and GEORGE S. FRAPS (*Rep. of Chemist, Agric. Exper. Stat. N.C.*, 1902—1903, 3—8).—Four soils, a poor sandy soil, a rich loamy soil, a rich clay soil, and a poor clay soil (500 grams of each), in jars, received calcium carbonate (5·1 grams) and 0·3 gram of nitrogen in the form to be tested. The jars were kept at a temperature of about 35° and water was added twice a week so as to maintain an amount equal to about one-third of the saturation capacity. After four weeks, the amount of nitrogen as nitrates was determined.

Nitrification varied somewhat in the different soils. Taking the amount of cotton-seed nitrified as 100 in each case, the variations were as follows: ammonium sulphate, 13 to 127; dried blood, 70 to 120; fish, 85 to 100; bone, 22 to 43.

In the case of farm-yard manure (16·1 grams to 500 grams of soil) there was less nitrification in three of the soils than occurred without manure, whilst in the fourth soil (the poor clay) 0·5 per cent. of the nitrogen was nitrified.

N. H. J. M.

**Studies on Nitrification.** GEORGE S. FRAPS (*Rep. of Chemist, Agric. Exper. Stat. N.C.*, 1902—1903, 9—30).—The number of nitrifying organisms in a soil varies according to conditions of moisture and temperature, &c., and their activity is periodic, rapid nitrification being preceded and followed by periods of less activity.

Soils contain two groups of nitrifying organisms, one which nitrifies cotton-seed meal, the other ammonium sulphate. The relative numbers of one group may be increased by growing in a soil containing the corresponding manure.



There are probably four groups of organisms, three which successively convert organic nitrogen into ammonium salts, nitrites and nitrates, and one which directly produces nitrites or nitrates from organic nitrogen.

Ammonium sulphate is nitrified more quickly than the phosphate, chloride, or citrate.

N. H. J. M.

**Nitrification of Ammonia fixed by Chabazite.** W. A. WITHERS and GEORGE S. FRAPS (*Rep. of Chemist, Agric. Exper. Stat. N.C.*, 1902—1903, 31—32).—Chabazite (250 grams) was kept for two days in a solution of ammonium chloride (40 grams in 1 litre). After being washed, it contained 1.26 per cent. of nitrogen. An amount containing 0.3 gram of nitrogen was added, with calcium carbonate (5.1 grams), to 500 grams of soil which were kept for 3 weeks at 35°. It was found that the ammonia absorbed by the chabazite was much more readily nitrified than ammonium sulphate, or cotton-seed meal, added directly to the soil. It is possible, therefore, that zeolitic silicates in soils may assist the nitrification of ammonium sulphate by fixing a portion of the salt.

N. H. J. M.

**Nitrifying Power of Typical North Carolina Soils.** W. A. WITHERS and GEORGE S. FRAPS (*Rep. of Chemist, Agric. Exper. Stat. N.C.*, 1902—1903, 33—39).—The nitrifying power of fifteen soils varied from 11 to 106, the lowest being sands with low water capacity, low humus, low absorptive power for ammonia, low acidity, and those containing a moderate amount of humus.

Acidity of the soil did not prevent the growth of nitrifying organisms, and low water capacity and atmospheric power are not necessarily coincident with low nitrifying power.

N. H. J. M.

**Fixation of Atmospheric Nitrogen by Dead Leaves.** ED. HENRY (*Bied. Centr.*, 1904, 33, 795—798; from *Ann. Sci. Agron.*, 1903, 8, 313).—Dead leaves of various trees were found to fix considerable amounts of atmospheric nitrogen. No fixation, or very little, was observed when leaves were kept on very dry sand; at the same time, there was no loss of nitrogen.

N. H. J. M.

**Changes in the Dimensions and Volume of Vegetable Organs and Tissues under the Influence of Desiccation.** MARCELLIN BERTHELOT (*Compt. rend.*, 1904, 139, 825—834).—The results of experiments with stems of *Festuca*, wheat and maize, and leaves of *Glycerium argenteum* showed that whilst the length was hardly altered by variations in the amount of water present, the diameter changed a good deal. Filter paper, free from ash, did not vary in length and very slightly in width and thickness. Ordinary filter paper varied slightly in width, more in length, whilst the thickness remained constant.

N. H. J. M.

**Vegetation in Atmospheres rich in Carbon Dioxide.** EM. DEMOUSSY (*Compt. rend.*, 1904, 139, 883—885).—Sixteen different plants were grown in normal air and in air containing 0.15 per cent.

of carbon dioxide. Fifteen of the plants gave much more dry matter in presence of the larger amount of carbon dioxide than in ordinary air, the amounts being as 122 to 262:100. The sixteenth plant, *Fuchsia*, produced 97 of dry matter with carbon dioxide against 100 in normal air, and this may have been due to other conditions of the experiments.

N. H. J. M.

#### Assimilation of Certain Ternary Substances by Vegetables.

PIERRE MAZÉ and A. PERRIER (*Ann. Inst. Pasteur*, 1904, 18, 721—747).—Sugars, glycerol, and methyl and ethyl alcohols retard for some days the germination of grains of maize, but do not inhibit the growth of the small plants. Sugars are assimilated in the dark, but light is essential for sugar synthesis. These substances added to a mineral solution are actively assimilated in the light, concurrently with those which result in chlorophylllic function. The plants grow more quickly than control specimens. These organic materials therefore contribute to plant anabolism. Glycerol is also absorbed in the light, but it hinders development. Ethyl alcohol is harmful, and leads to the production of aldehyde. Methyl alcohol activates vegetation and is presumably absorbed. The tolerance of plants to alcohols varies a good deal. Dextrin sometimes causes chlorosis; in this condition, produced by want of iron, the result is partly due to excess of bases which fix the iron.

W. D. H.

Decomposition of Fallen Leaves. ED. HENRY (*Bied. Centr.*, 1904, 33, 793—794; from *Ann. Sci. Agron.*, 1902—1903, 8, 328).—Leaves of aspen, when kept over sand in wooden boxes, lost, in eleven months, 52 per cent., and when chalk was employed instead of sand, 45 per cent. The much lower results obtained in earlier experiments are now shown to be due to zinc boxes having been employed. Leaves of *Carpinus betulus*, which are much less leathery and contain less tannin than oak leaves, do not decompose more quickly than the latter.

N. H. J. M.

Formation and Distribution of the Essential Oil of an Annual Plant. EUGÈNE CHARABOT and G. LALOUE (*Compt. rend.*, 1904, 139, 928—929).—The essential oil migrates from the leaves to the flower along with carbohydrates. After fructification, the migration of nutritive matters to the flower ceases, and the essential oil seems to return to the leaves.

In the plant examined (basil), it was found that most of the essential oil is in the leaves and flowers. The stems only contain a little, and the roots none at all.

N. H. J. M.

#### Occurrence of Ricinine in Young Ricinus Plants.

ERNST SCHULZE and ERNST WINTERSTEIN (*Zeit. physiol. Chem.*, 1904, 43, 211—221).—The compound described as ricidine (Abstr., 1898, i, 42) is now shown to be identical with ricinine,  $C_8H_8O_2N_2$  (Maquenne and Philippe, Abstr., 1904, i, 339). It gives a characteristic reaction very similar to the murexide reaction, and also gives the Weidel reaction. The amounts present in young etiolated, or even green, plants are some

12—15-fold that contained in the same number of seeds. So far tyrosine and lycine have not been obtained from these plants.

J. J. S.

**A Substance which Inhibits the Fat-splitting Action of the Seed of *Abrus Precatorius*.** KARL BRAUN (*Chem. Zeit.*, 1905, 29, 34. Compare Abstr., 1903, ii, 748).—An aqueous extract of the seeds of *Abrus precatorius* was injected subcutaneously into rabbits, the serum from which was then used in the experiments described. The aqueous extract itself was added to castor oil and the slight amount of hydrolysis of the latter estimated. The addition of the serum lessened the extent of this hydrolysis when the latter was conducted at low temperatures.

A. McK.

**Presence of Trehalase in Fungi.** ÉMILE BOURQUELOT and HENRI HÉRISSEY (*Compt. rend.*, 1904, 139, 874—876).—Trehalase was found in the tops of *Boletus edulis*, *B. aurantiacus*, and *Cortinarius elatior*, but not in the tubes and lower parts. It also occurs in *Paxillus involutus* and *Russula delica*, and in smaller quantity in *Boletus badius* and *Amanita muscaria*.

N. H. J. M.

**Medicinal and Useful Plants of Brazil.** THEODOR PECKOLT (*Chem. Centr.*, 1904, ii, 1618—1619; from *Ber. Deut. Pharm. Ges.*, 14, 372—388. Compare Abstr., 1904, ii, 764).—Most of the following Labiatae:—*Ocimum basilicum*, *O. carnosum*, *O. micranthum*, *Aeolanthus suavis*, *Peltodon radicans*, *Heptis spicata*, *Hyptis Salzmanni*, *Heptis fasciculata*, *Cunila galioides*, *Salvia splendens*, *Leonurus sibiricus*, *Leonitis nepetaefolia*, and *Scutellaria uliginosa*—contain considerable quantities of ethereal oils and resins, often together with an amorphous bitter principle; glucosides and alkaloids are, however, seldom present in these plants. The abstract contains some account of these substances, which are prepared in most cases from the leaves; the yields and the quantitative composition of various parts of the plants are also given.

E. W. W.

**Proteids of Wheat Gluten and its Relations to the Baking Properties of Wheat Flour.** JOSEF KÖNIG and P. RINTELEN (*Zeit. Nahr. Genussm.*, 1904, 8, 721—728. Compare Abstr., 1904, i, 1066).—The amounts of water, ash, total nitrogen, nitrogen in substances soluble in 65—70 per cent. alcohol, nitrogen as gluten, and the total gluten were determined in seven samples of wheat flour and in three samples of spelt wheat flour. The quality of the flour was also ascertained by making loaves, the actual volume of the loaves being determined by Kreusler's and Maurizio's method. The results showed that one of the spelt loaves was of bad quality, although the meal, as regards gluten proteid soluble in alcohol, did not differ from ordinary wheat-meal. The quality, therefore, depends as little on the gluten alone as on the relation of total gluten, or of the insoluble portion, to the portion soluble in alcohol.

N. H. J. M.



**Composition of Rice Refuse.** GEORGE S. FRAPS (*Chem. Centr.*, 1904, ii, 1430; from *Bull. Texas Agr. Exper. Stat.*, '73, 3).—The composition of rice hulls is similar to that of wheat straw. The bran, consisting mainly of the seed-skin without much of the hulls, should contain at least 10 per cent. of proteids and not more than 20 per cent. of crude fibre. Addition of hulls lowers the value. The mixture of bran, meal, and hulls, in the proportions present in the whole seed, contains about 7.5 per cent. of proteids and 28 per cent. of crude fibre; its value is about half that of the pure bran. N. H. J. M.

**Volatile Fatty Acids in Cheese. Biology of the Cheese Ferment.** ORLA JENSEN (*Centr. Bakt. Par.*, 1904, ii, 13, 161—170, 291—306, 428—439, 514—527, 604—615, 687—705, and 753—765).—Acetic and formic acids were always found to be present, the latter, however, frequently only in traces. Cheeses, the ripening of which depends chiefly on mould fungi, contain only small amounts of acetic and formic acids. All other cheeses contain some, and often considerable amounts of, propionic acid.

Valeric acid was only found in Backstein cheese, made by the Limburg method, but traces probably occur in all kinds of cheese.

Rennet cheeses do not contain appreciable amounts of butyric acid, owing, probably, to the low temperature of cheese ripening and the consequent luxuriance of the lactic ferment. Schabzeiger cheese, in which the lactic ferments are killed, contains considerable amounts (0.45 per cent.) of butyric acid.

Cheeses in which a considerable decomposition of fat has taken place generally contain a good deal of ammonia, but in no case was sufficient ammonia found to show an alkaline reaction with phenolphthalein. Alkalinity, as indicated by litmus, often occurs with soft cheeses.

As regards the aromas of different cheeses, amino-acids are prominent in Emmenthaler cheese, butyric esters in Roquefort, and products of putrefaction in Limburger cheese.

*Bacillus casei limburgensis* alone produces only primary albumoses. *Micrococcus casei liquefaciens*, *Paraplectrum fetidum*, and *B. nobilis* produce chiefly peptones, amino-acids, and ammonia. N. H. J. M.

**Lime Requirements of Hessian Soils.** TH. DIETRICH (*Bied. Centr.*, 1904, 33, 814—818; from *Ber. landw. Versuchs-Stat. Marburg*, 1903).—Application of lime (as burnt lime, lime marl, and dolomite marl) was beneficial in the case of the lighter soils, from sand to sandy loam. Well cultivated soils which contain little lime can do without liming better than badly cultivated soils, possibly because of the presence of calcium compounds other than carbonate, such as humate and sulphate. Calcium silicate, which occurs in less cultivated soils, is probably unable to take the place of calcium carbonate.

N. H. J. M.

**Manurial Value of Human Excrement.** JOHN SEBELIEN (*Bied. Centr.*, 1904, 33, 805—808; from *Tidsskr. Norsk. Landbr.*, 1904, 45—55, and *J. Landw.*, 1904).—The results of experiments with oats

showed the value of fæces as a nitrogenous manure to be 75 as compared with sodium nitrate = 100. The value, however, when compared with a mixture of sodium nitrate with phosphatic and potassium manure, was 63 per cent. The nitrogen of urine is shown to be about equal in value to that of sodium nitrate.

Notwithstanding the considerable manurial value of fæces, the conclusion is drawn that, as regards the total excreta, the fæces are only one-ninth the value of the urine, as the latter is produced in so much larger quantity.

N. H. J. M.

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## Analytical Chemistry.

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**Sodium Nitrate containing Perchlorate.** HENRI PELLET and G. FRIBOURG (*Bied. Centr.*, 1904, **33**, 798—803; from *Ann. Sci. Agron.*, 1902—1903, **8**, ii, 199).—The amounts of perchlorate vary from traces to 1.5 per cent., but as much as 3.2 and even 6 per cent. reckoned as potassium salt have been found. According to de Caluwe, less than 1 per cent. of sodium perchlorate is injurious to vegetation, whilst potassium perchlorate and chlorate are much less injurious.

When sodium nitrate contains perchlorate, the chlorate is present only in small quantity. Potassium is always present, but seems to have no relation to the amount of perchlorate.

Vincente and Lafitte detect chlorates, in presence of chlorides, perchlorates, and nitrates, by adding to the solution a few drops of a solution of aniline in water (1:40) and an equal volume of hydrochloric acid of 22° B. A reddish-violet coloration, which turns to an intense blue, is produced when traces of chlorate are present.

N. H. J. M.

**Use of Chromates of Barium and of Silver in the Estimation of Sulphates and Chlorides.** LAUNCELOT W. ANDREWS (*Amer. Chem. J.*, 1904, **32**, 476—480).—*Estimation of Sulphates.*—The process published by the author in 1890 consisted in precipitating the alkali sulphate with a solution of barium chromate in dilute hydrochloric acid; after removing the excess of barium chromate by neutralisation, the alkali chromate formed in the reaction was estimated iodometrically. The author now states that in practice it will be found more convenient to use a solution of barium chromate in *N*-trichloroacetic acid, which, unlike the hydrochloric acid solution, is perfectly stable.

*Estimation of Chlorides.*—Silver chromate is a valuable reagent for the estimation of very small quantities of chlorine, say, in drinking-waters. On agitating the water with this reagent, silver chloride is formed, and the filtrate contains alkali chromate, which may then be estimated colorimetrically.

L. DE K.

**Estimation of Tellurium.** ALEXANDER GUTBIER (*Chem. Centr.*, 1904, ii, 1554—1555; from *Sitzungsber. phys. med. Soc.*, 1904, 130—133).—The tellurium is separated by reduction with hydrazine hydrate, washed with lukewarm water, and dried, preferably, in a current of hydrogen. L. DE K.

**Iodometric Estimation of Telluric Acid.** ALEXANDER GUTBIER and F. RESENSCHECK (*Chem. Centr.*, 1904, ii, 1555; from *Sitzungsber. phys. med. Soc.*, 1904, 138—142).—Telluric acid cannot be accurately estimated by distillation with hydrochloric acid and subsequent iodometric estimation of the chlorine evolved. L. DE K.

**Estimation of Nitrogen in Organic Compounds.** HENRY C. SHERMAN and M. J. FALK (*J. Amer. Chem. Soc.*, 1904, 26, 1469—1474).—The authors state that even in the case of alkaloids the Kjeldahl method, as modified by Dyer, may be successfully employed if the boiling be continued for at least two hours after the liquid has become colourless (compare Dyer, *Trans.*, 1895, 67, 812). L. DE K.

**Volumetric Estimation of Hydroxylamine by means of Tervalent Titanium.** ARTHUR STÄHLER (*Ber.*, 1904, 37, 4732—4733).—Hydroxylamine is quantitatively reduced to ammonia by titanium trichloride or trisulphate, and, since the excess of the titanium salt can be easily estimated by titration with permanganate or ferric chloride, a convenient method of estimating hydroxylamine, especially in organic compounds, is obtained. Hydrazine sulphate is not acted on by titanium salts under like conditions. E. F. A.

**Estimation of Phosphorus in Iron Ores.** JAMES S. ROWLAND and LLEWELYN J. DAVIES (*J. Soc. Chem. Ind.*, 1904, 23, (24), 1186—1187. Compare *Trans.*, 1866, 19, 148).—One to two grams of the finely powdered ore are mixed with one gram of calcined magnesia and heated in a muffle furnace at a bright red heat for about an hour. The cooled mass is boiled with 50 per cent. nitric acid, when a solution containing all the phosphorus is obtained. The phosphorus is then precipitated by ammonium molybdate and the washed precipitate dissolved in a definite volume of standard sodium hydroxide solution, which is then titrated with nitric acid, using phenolphthalein as indicator. Results are given to show the accuracy of the process. H. M. D.

**Estimation of Phosphoric Acid in Food-stuffs.** ÉMILE FLEURENT (*Bull. Soc. chim.*, 1905, [iii], 33, 101—103).—The author finds that Garola's process (*Abstr.*, 1897, ii, 596) for the estimation of phosphoric acid in wheat flour is inconvenient. Larger quantities of material may be used and the operation carried out more rapidly if the flour is destroyed with fuming nitric acid and the product from this operation treated with sulphuric acid, as in the Kjeldahl process, for the final destruction of the organic matter. The residue so obtained is diluted,



neutralised with ammonia, some ammonium chloride added, and the phosphoric acid estimated with "magnesia mixture." T. A. H.

**Colorimetric Estimation of Phosphates.** OSWALD SCHREINER and BAILEY E. BROWN (*J. Amer. Chem. Soc.*, 1904, 26, 1463—1468. Compare Abstr., 1904, ii, 85).—The process may be briefly summarised as follows. The solution, drinking water for instance, is mixed with a drop of ammonia and a few drops of ammonium oxalate and evaporated to dryness. The residue is moistened with magnesia mixture, and after a few hours it is washed several times with small quantities of ammonia water and finally once with plain water.

The precipitate, which now contains any phosphoric acid as triple phosphate, is dissolved in nitric acid and tested colorimetrically by the authors' improved molybdate process. L. DE K.

**Estimation of Arsenic.** R. C. COWLEY and J. P. CATFORD (*Pharm. J.*, 1904, 73, 897).—The following manner of applying Reinsch's test is described. A fine copper wire, coiled into a helix, is immersed in 10 c.c. of the liquid to be tested, to which 2 c.c. of hydrochloric acid have been added. The liquid is contained in a test-tube and the copper helix should reach from the bottom of the liquid to above its surface. The test-tube and its contents are placed for 1 hour in a salt-water bath kept at a temperature just below its boiling point. At the end of this time, the exposed length of wire is pressed down below the surface and the heating continued for a further 15 minutes. If all the arsenic has been removed from the liquid, this upper portion of the wire will remain bright. The helix is then removed, washed, and the arsenical deposit dissolved off by 1 c.c. of bromine water containing a little hydrobromic acid. After washing the wire, the arsenical solution is treated with 1 c.c. of potassium hydroxide solution and boiled until the light green copper compounds are decomposed. The copper oxides are collected on a filter, the arsenate in the filtrate reduced to arsenite and titrated with  $N/100$  iodine solution. The latter should be standardised with an arsenical solution of known strength. It is asserted that the method is capable of measuring 0.033 milligram of arsenic. W. P. S.

**Examination of Drugs for Arsenic.** WILLIAM A. H. NAYLOR and E. J. CHAPPEL (*Pharm. J.*, 1905, 74, 33, 34).—The authors have examined most of the drugs of the British Pharmacopœia in order to see whether they complied with the limits proposed in the recently issued report presented to the Pharmacopœia Committee of the General Medical Council. The methods employed were those recommended in this report. A large proportion of the drugs, &c., came within the prescribed limits for arsenic, the exceptions being: antimony oxide, 1000; bismuth carbonate, 5; glycerol, 4; iron, 500; potassium carbonate, 4; reduced iron, 100; sulphonol, 6; and tartarated antimony, 500 parts of arsenic per million. The drugs were purchased through the ordinary channels, the only stipulation made being that they should answer the requirements of the Pharmacopœia. The inference drawn from the results of the experiments is that the

recommendations as to the arsenic limit are, except in the case of a few drugs, capable of practical fulfilment. W. P. S.

**Rapid Estimation of Silicon in Ferrosilicon.** LOUIS LUCCHÈSE (*Ann. Chim. anal.*, 1904, 9, 452—453).—0.5—1 gram of the finely powdered sample is treated in a weighed platinum crucible with 1 c.c. of hydrofluoric acid, 1 c.c. of nitric acid is added, and the whole evaporated to dryness. After adding another c.c. of hydrofluoric acid and evaporating, the mass is calcined. After another treatment with hydrofluoric and nitric acids, the mass is finally ignited to constant weight, and the resulting ferric oxide multiplied by 0.7 represents metallic iron, which, deducted from the original weight, gives the silicon. The impurities present in commercial samples are not sufficiently large to affect the result. L. DE K.

**The Microscopic Examination of Metals.** JOHN H. B. JENKINS and D. G. RIDDICK (*Analyst*, 1905, 30, 2—15).—This paper deals mainly with the microscopic examination of mild steel. The methods of preparing the sections are fully described, and include the polishing, etching, heat-tinting, and mounting of the specimens. Forty-one photo-micrographs are given to illustrate the specimens mentioned in the paper, comprising iron crystals, pig irons, mild steels, cemented steels, manganiferous steels, pearlite, copper, "burnt" copper, annealed steel, flaws in steel, cast-steel, &c. W. P. S.

**Precipitation of Barium Bromide by Hydrobromic Acid.** NORMAN C. THORNE (*Amer. J. Sci.*, 1904, [iv], 18, 441—444).—If a concentrated solution of barium bromide or chloride is treated with an excess of a mixture of equal parts of hydrobromic acid and ether, the barium is precipitated quantitatively as bromide. It is advisable to saturate the mixture with hydrogen bromide, which is conveniently made by dropping liquid bromine into a solution of naphthalene in petroleum and passing the evolved gas through a purifying tower charged with glass wool and red phosphorus. The precipitate is collected on a weighed asbestos pad, washed with the acid ether mixture, mixed with a little ammonium bromide, and finally heated at 250° to constant weight. The process may be used in the presence of calcium and magnesium.

If, however, barium bromide is treated with hydrochloric acid and ether, it is practically precipitated as chloride. If barium chloride is partially precipitated with hydrochloric acid and then mixed with an amount of hydrobromic acid which by itself would not have caused any precipitate, a mixture of barium chloride and bromide is obtained. L. DE K.

**Estimation of Lead and Antimony as Sulphides.** JOSEPH A. MULLER (*Bull. Soc. chim.*, 1904, [iii], 31, 1300—1303).—It is proposed to precipitate the sulphides of these metals in warm, slightly acid solution and to wash the precipitates, previously collected on tared filters, successively with (1) a solution of hydrogen sulphide in water, (2) alcohol (95 per cent.), (3) a mixture of equal volumes of alcohol, ether,

and carbon disulphide, and (4) ether, and then to dry them under reduced pressure over sulphuric acid. The results of a number of trials of this method quoted in the original indicate that it gives trustworthy results.

T. A. H.

**Analysis of Lead Minerals.** JOSEPH A. MULLER (*Bull. Soc. chim.*, 1904, [iii], 31, 1303—1306).—The finely powdered mineral is warmed with nitric acid for 12 hours, and the residue, left after evaporation of the excess of acid, treated first with warm water and then with hydrochloric acid at 80°. From the aqueous solution, the iron is precipitated by the addition of sodium acetate and subsequent ebullition, and the silver as the chloride. To the filtrate are added (a) the hydrochloric acid solution prepared from the original residue, and (b) the precipitate of basic ferric acetate previously dissolved in hydrochloric acid, and the whole is largely diluted with water, then warmed, and saturated with hydrogen sulphide. The precipitate is first washed with a solution of sodium or ammonium sulphide, arsenic being estimated as magnesium ammonium arsenate, and antimony as the sulphide (compare preceding abstract) in the washings; next the residue is washed with alcohol, &c., as already described (*loc. cit.*), and weighed. If copper is present, this is determined by treating an aliquot portion of the precipitate with nitric acid followed by sulphuric acid, and estimating the copper in the soluble portion by one of the usual methods. The lead sulphide precipitate may also contain a small quantity of silver sulphide; this may be estimated by reduction and cupellation. The remaining constituents of the mineral are determined in the usual way.

T. A. H.

**Analysis of Ferrosilicons; Use of Sodium Peroxide in Platinum Crucibles.** LOUIS LUCCHÈSE (*Ann. Chim. anal.*, 1904, 9, 450—451).—When copper or nickel crucibles are used for fusions with sodium peroxide, the fused mass is always contaminated with copper or nickel oxides, which complicates the analysis. No such inconvenience is experienced when using a platinum crucible.

For the assay of ferrosilicon, 1 gram (or less) of the finely powdered sample is mixed by means of a spatula with 2 grams of dry sodium carbonate and 2 grams of sodium peroxide contained in a platinum crucible. After heating for 5 minutes very gently over a small Bunsen flame or a spirit lamp, the crucible is seized with a pair of nickel tongues and, with constant rotary movement, heated to dull redness for 15 minutes, when the fused mass is at once turned out. The mass, which contains the silicon as silicate, is then analysed as usual. L. DE K.

**Estimation of Chromium in Steel.** FRED IBBOTSON and R. HOWDEN (*Chem. News*, 1904, 90, 320—321).—The sample is dissolved in a small amount of nitric acid of sp. gr. 1.20 and heated to expel nitrous fumes. After copious dilution, 2—3 grams of ammonium persulphate and about 0.01 gram of silver nitrate are added and the solution heated until the chromium and manganese are completely oxidised. If the quantity of the latter metal be large, manganese dioxide may separate, and must be removed by filtration. The solution is cooled, treated with excess of ammonium acetate, and lead



acetate solution is added. The precipitated lead chromate is collected on an asbestos filter, washed with dilute ammonium acetate solution, and then dissolved off the filter with nitric acid. After diluting the solution, an excess of standard ferrous sulphate solution is added, and the estimation completed by titration with  $N/20$  potassium permanganate solution.

Steels containing large quantities of tungsten cannot be completely decomposed by nitric acid alone. In this case, 0.5 gram of the sample is heated with 10 c.c. of sulphuric acid (1:4) until nearly dissolved, 2 c.c. of nitric acid of sp. gr. 1.2 are then added, and, after boiling, 100 c.c. of water. To this solution, containing much of the tungsten as precipitated oxide, 20 c.c. of the nitric acid and 20 c.c. of a 0.2 per cent. silver nitrate solution are added, together with 3 grams of ammonium persulphate. The mixture is gradually brought to boiling, then cooled, ferrous sulphate solution is added, and the titration completed as above described.

W. P. S.

**Estimation of Chromium in Steel.** FRED IBBOTSON and R. HOWDEN (*Chem. News*, 1905, 91, 3).—Chromium and manganese may be estimated in one portion of a sample of steel according to the following method. The manganese is oxidised in a cold nitric acid solution of the steel by means of sodium bismuthate and titrated in the usual manner. About 50 c.c. of nitric acid of sp. gr. 1.2 and 10 grams of sodium bismuthate are then added and the mixture boiled. A small quantity of manganous sulphate is added and the boiling continued for a minute or so. The manganic oxide is then collected on a filter and the chromic acid estimated in the filtrate.

W. P. S.

**Electrolytic Estimation and Separation of Antimony and Iron. The Trisulphide Method for Estimating Antimony.** ARTHUR FISCHER (*Zeit. anorg. Chem.*, 1904, 42, 363—417. Compare Abstr., 1903, ii, 616).—The electrolytic reduction of tin from the solution of the tin ammonium thio-salt is easily accomplished by means of a platinum cathode covered by a layer of tin, on the addition of sodium sulphite to the ammonium sulphide used. The use of a platinum iridium anode is recommended.

Antimony may be quantitatively separated from a solution of the thioantimonite or from the thioantimonate in sodium sulphide on the addition of potassium cyanide. The presence of polysulphides in the solution prior to electrolysis is immaterial, since they are easily reduced by the potassium cyanide present. A platinum iridium anode is also preferable in this case to a platinum anode.

The electrochemical equivalent of antimony in thioantimonite is  $Sb/3$  and in thioantimonate  $Sb/5$ . The quinquevalency of antimony favours the reversibility of the reaction, whilst the tervalency does not.

The separation of antimony from tin may be effected from sodium sulphide solution to which potassium cyanide is added. The separation is accomplished both when tervalent and quinquevalent antimony compounds are employed. The solution must be saturated at  $30^{\circ}$  with sodium sulphide and must contain from 2 to 4 grams of sodium hydr-

oxide. The temperature must not exceed  $30^{\circ}$  nor the tension 1.1 volts.

In the absence of potassium cyanide, only trivalent antimony can be separated from tin with accuracy. The electrolyte must, in this case, be saturated at  $50^{\circ}$  with sodium sulphide, and the tension must not exceed 0.9 volt.

Sodium hydrosulphide is unsuitable for the separation, since the potentials of antimony and tin towards its solution are only very slightly different.

The addition of sodium hydroxide to the electrolyte, as recommended by Classen, is absolutely essential.

The trisulphide method for estimating antimony gives results lower than those obtained by the electrolytic method. A. McK.

**Estimation of Chloroform Vapour by a Tonometric Method.** B. J. COLLINGWOOD (*Proc. physiol. Soc.*, Nov., 1904, ii—iii; *J. Physiol.*, 32).—The principle of the method is as follows: one chamber contains the mixture of air and chloroform, another air only; the two are connected by a manometer. An equal amount of chloroform is added to both, and the difference in the levels of the water or mercury in the two limbs of the manometer is proportional to the percentage of the chloroform originally present. The method gives good results, and these are not affected by the presence of carbon dioxide. W. D. H.

**Estimation of Chloroform Vapour in Air.** ALFRED G. LEVY (*Proc. physiol. Soc.*, Nov., 1904, iii—iv; *J. Physiol.*, 32).—Waller's densimetric method was compared with Vernon Harcourt's combustion method. The results agree very closely, the former method giving as a rule slightly higher results. W. D. H.

**Estimation of Glycerol in its Solutions by means of the Specific Gravity.** C. STIEPEL (*Chem. Centr.*, 1904, ii, 1626—1627; from *Seifensiederzeit.*, 31, 818).—The amount of glycerol in a crude sample which is reasonably free from other organic matters may be determined by subtracting from the percentage, as deduced from the sp. gr., the percentage of ash multiplied by 3.33. This, however, only holds good for small amounts of salts. If the sample is very concentrated, the determination of the sp. gr. is somewhat troublesome. In this case, it may be slightly diluted with a known weight of water. L. DE K.

**Assay of Glycerol.** TAUREL (*Chem. Centr.*, 1904, ii, 1258; from *Mon. Sci.*, 18, 574—577).—When testing crude glycerol by means of Hehner's dichromate process, it is necessary to first remove certain objectionable matters by addition of basic lead acetate. The author prepares this by dissolving 1 mol. of lead acetate and adding half a mol. of sodium hydroxide. Any excess of lead in the filtrate must be carefully removed by sodium sulphate. Alkaline samples should be first neutralised with acetic acid before clarifying with the lead. If there is much sodium chloride present, there is a risk of chlorine escaping during the heating with potassium dichromate and sulphuric acid.

The author therefore recommends connecting the flask with a bulb tube containing a standard solution of arsenious acid, and in this way estimating the chlorine and allowing for it. When testing glycerol for sulphides, acetic acid should be used in the cold. When testing for arsenic by Gutzeit's test, any sulphur compounds should be first fully oxidised with potassium permanganate before adding zinc and hydrochloric acid.

L. DE K.

**New Test for Cholesterol.** CARL NEUBERG and DORA RAUCH-WERGER (*Chem. Centr.*, 1904, ii, 1434—1435; from *Festschr. für Ernst Salkowski*, 279—285).—A trace of cholesterol is heated with 1.5 c.c. of absolute alcohol, and a minute particle of rhamnose or a drop of solution of  $\delta$ -methylfurfuraldehyde is added. When quite cold, an equal bulk of sulphuric acid is allowed to run down the sides of the test-tube, when a characteristic raspberry-red ring will at once be noticed. If the tube is well cooled and shaken, the whole liquid becomes red and shows, after being diluted with alcohol, a characteristic dark absorption band between *E* and *C*. If the mixture becomes overheated, the liquid assumes a brown colour, and then shows a second absorption band in the neighbourhood of *D*. Phytosterol does not give the reaction, or at most a rose colour which gives an absorption band in the yellowish-green.

The reaction is, however, shared by some hydroaromatic compounds, such as biliary acids, also by camphor, borneol, menthol, and similar substances.

L. DE K.

**Corrections to be Applied in the Estimation of Lactose in Cows' Milk and Human Milk.** GUSTAVE PATEIN (*J. Pharm. Chim.*, 1904, [vi], 20, 501—505).—Attention is drawn to the necessity of correcting for the volume of the precipitated casein and fat in this estimation, particularly when the analysis is made on the undiluted milk. Lactose cannot be estimated polarimetrically in human milk on account of the presence of a laevorotatory substance which is not precipitated by mercuric nitrate or by picric acid. As this substance, however, does not reduce Fehling's solution, the volumetric method may be used.

W. P. S.

**New Reaction for Lactose (and Maltose).** ALFRED WÖHLK (*Zeit. anal. Chem.*, 1904, 43, 670—679).—Lactose or maltose heated with 10 per cent. ammonia for 15—20 minutes develops a bright madder-red colour, of considerable permanence. Other carbohydrates give either no colour or a yellow to yellowish-brown one, and do not obscure the lactose reaction. The reaction is, however, inhibited by various substances, such as tartrates, citrates, and ammonium salts.

M. J. S.

**Composition and Analysis of Maple Syrup and Maple Sugar.** JULIUS HORTVET (*J. Amer. Chem. Soc.*, 1904, 26, 1523—1545).—A lengthy paper giving the results of the analysis of a large number of pure and adulterated samples of maple sugar and syrup. For full particulars of the analytical operations and results, the original paper



should be consulted. Considerable importance is attached to the volume occupied by the precipitate formed on adding basic lead acetate. The amount of malic acid and the alkalinity of the ash also give valuable indications as to the genuineness of the samples.

L. DE K.

**Table for the Rapid Calculation of the Original Extractive Matter of Beer Wort.** PAUL LEHMANN and HERMANN STADLINGER (*Zeit. anal. Chem.*, 1904, 43, 679—687).—The formula,

$$\epsilon = \frac{100(E + 2.0665A)}{100 + 1.0665A}, \text{ for}$$

the calculation of the original extractive matter,  $\epsilon$ , from the percentage of alcohol,  $A$ , and the extractive matter of the beer,  $E$ , may be expressed in the form

$$\epsilon = E \frac{100}{100 + 1.0665A} + \frac{206.65A}{100 + 1.0665A}, \text{ or}$$

$\epsilon = E.(A\alpha) + (A\beta)$ . The table gives the values for  $A\alpha$  and  $A\beta$  for each 1/100 per cent. of alcohol from 1.5 to 4.99 per cent., and the calculation is thereby resolved into the multiplication of the factor  $A\alpha$  by  $E$ , and addition of the corresponding number  $A\beta$ . M. J. S.

**Estimation of Carbamates.** JOHN J. R. MACLEOD and H. D. HASKINS (*Amer. J. Physiol.*, 1904, 12, 444—456).—Carbamates are present in the urine when urea formation is interfered with. Previous methods for detecting these salts are unsuitable for quantitative work. The present paper is limited to a description of a new method and proofs of its accuracy. The principle of the method is to determine the yield of carbon dioxide from the liquid by the Barcroft-Haldane method, and again in the same liquid after precipitation of the carbonates by barium hydroxide and ammonia. In liquids which contain proteid, a slight modification is necessary. W. D. H.

**Detection of Acetates, Cyanides, and Lithium.** STANLEY R. BENEDICT (*Amer. Chem. J.*, 1904, 32, 480—483).—*Detection of Acetates.*—The process is based on the fact that a solution of cobalt nitrate containing a little free acetic acid gives practically no precipitate with hydrogen sulphide, but does so at once when an alkali acetate is added; also on the fact that silver acetate is slightly soluble.

The solution is mixed with slight excess of sodium carbonate, and then with slight excess of silver nitrate. After carefully removing this by sodium chloride, the filtrate is saturated with hydrogen sulphide. On pouring the liquid into 2 c.c. of *N*-cobalt nitrate containing a few drops of acetic acid and saturated with hydrogen sulphide, a more or less heavy precipitate of cobalt sulphide will be formed should an acetate be present.

*Detection of Cyanides in the presence of Ferrocyanides.*—The solution is made alkaline with sodium hydroxide, and about 1 c.c. of *N*/25 mercurous nitrate is gently poured over it. A ring of black mercurous oxide is thus formed, which, however, in the presence of a trace of cyanide will on shaking partly dissolve, whilst the rest turns a light grey.

*Detection of Lithium in the presence of Sodium.*—To the solution is added a little ammonia, and then one-tenth of the volume of *N/5* sodium phosphate, and finally enough alcohol to produce a fairly heavy permanent precipitate, which may be simply sodium phosphate or contain admixed lithium phosphate. The solution is now heated to boiling, when, should lithium be absent, it will become perfectly clear, but in the presence of lithium its phosphate remains undissolved.

L. DE K.

**Detection and Estimation of Citric Acid in Wines.** LUCIEN ROBIN (*Ann. Chim. anal.*, 1904, 9, 453—456).—The following reagents are required: (1) a 40 per cent. solution of lead acetate, (2) a mixture of 1 vol. of glacial acetic acid and 9 vols. of water, (3) a strong solution of potassium hydroxide, (4) a mixture of 1 vol. of glacial acetic acid and 9 vols. of alcohol, (5) a hot saturated alcoholic solution of cadmium acetate.

Twenty-five c.c. of wine are heated to boiling, 3 c.c. of (1) are added, and, after boiling for a few minutes, the precipitate is collected, washed, and then heated for 5 minutes at 90° with 10 c.c. of (2). After washing the residue with the acid water, the filtrate is freed from lead by means of hydrogen sulphide and evaporated to incipient dryness. The residue is now dissolved in 5 c.c. of alcohol, and, after being neutralised with (3), 0.5 c.c. of glacial acetic acid is added, and, after stirring, the liquid is passed through a filter and the deposit washed twice with 5 c.c. of (4). After the last traces of potassium hydrogen tartrate have separated and been removed by filtration, the citric acid is precipitated by adding 6 drops of (5), collected on a tared filter, washed with alcohol, dried at 100°, and weighed. The weight multiplied by 0.5378 = citric acid.

After weighing, it may be further identified as a citrate by Denigès' mercurial reagent.

L. DE K.

**Estimation of Amino-acids in Urine.** FRANZ ERBEN (*Zeit. physiol. Chem.*, 1904, 43, 320—324).—An adaptation of the method already employed by E. Fischer and Bergell, and by Ignatowski, in which naphthalene- $\beta$ -sulphonic chloride is the reagent employed. Normal urine contains a conjugated amino-acid, hippuric acid, which does not give the reaction in question. In the investigation of urine, it is first necessary to remove and estimate the hippuric acid. When this is done, normal urine and many pathological urines give no further evidence of amino-acids. From experiments with mixtures of urine and amino-acids (glycine, alanine, leucine, tyrosine), the method is shown not to be accurate quantitatively, from 57 to 80 per cent. only of the added acid being recoverable.

W. D. H.

**The Reactions Concerned in the Estimation of the Iodine Value.** FREDERIK H. VAN LEENT (*Zeit. anal. Chem.*, 1904, 43, 661—670).—From a discussion of the work of von Hübl, Waller, Ephraim, Marshall, Wijs, and others, the author draws the following conclusions: (1) the active constituents of the solutions of von Hübl, Ephraim, and Wijs are iodine monochloride and hypoiodous acid;

both of these form additive products and are iodometrically equivalent, (2) no combination or liberation of hydrochloric acid takes place during the iodine absorption, (3) the hydrochloric acid which becomes free during the reaction is a product of the hydrolytic decomposition of iodine monochloride, (4) no substitution of hydrogen by halogens takes place, (5) the iodine value is a measure of the unsaturated compounds present in the fat, (6) the Wijs solution of iodine monochloride in 99 per cent. acetic acid is to be preferred for the reaction.

M. J. S.

**A Simple Method for the Estimation of the Fat in Butter.** A. HESSE (*Zeit. Nahr. Genussm.*, 1904, 8, 673—675).—From 1.5 to 2 grams of the well-mixed sample are placed in a Gottlieb's cylinder and treated with 8 c.c. of hot water. If necessary, the cylinder is placed in warm water until the butter is melted. One c.c. of ammonia and 10 c.c. of alcohol are then added, and the mixture shaken to dissolve the casein. After cooling, 25 c.c. of ether and 25 c.c. of light petroleum are added, and the whole thoroughly mixed. When the ethereal solution of the fat has separated, it is drawn off and the residue again treated with 50 c.c. of ether, which is drawn off without having been shaken up, and finally with 50 c.c. of the mixture of ether and petroleum. The united ethereal solutions are evaporated and the residue of fat weighed.

W. P. S.

**The "Sinacid" Butyrometer.** DU ROI and KOEHLER (*Milch. Zeit.*, 1904, 33, 787—790).—This instrument, devised by A. Sichler, is intended for the estimation of fat in milk, the method of procedure resembling that of Gerber. Its name is derived from the fact that the sulphuric acid of the latter process is dispensed with (*sine acido*), a salt solution being used instead. The composition of this solution is not given, as the patent rights have not yet been secured, but it has an alkaline reaction. The amyl alcohol of the Gerber process is replaced by another higher alcohol. The new method gives results closely agreeing with those yielded by Gerber's process, but the authors consider that the latter is to be preferred where many samples of milk have to be examined, on account of its rapidity.

W. P. S.

**Colour Reaction of Cotton Seed Oil.** GEORGES HALPHEN (*Bull. Soc. chim.*, 1905, [iii], 33, 108—110).—It is shown that, after cotton seed oil has been fully brominated, it does not give Halphen's colour reaction (*Abstr.*, 1898, ii, 358), but that oil coloured by the reagent retains its colour on subsequent bromination. The substance to which the production of the colour is due is not present in the "unsaponifiable matter," and is probably an unsaturated acid. When cotton seed oil is treated with water, the "active principle" is not removed, but wet oil gives an orange-brown colour instead of the normal red colour with Halphen's reagent. The passage of hydrogen sulphide through cotton seed oil produces no coloration. These observations do not support Raikow's view (*Abstr.*, 1900, ii, 698, and 1902, ii, 366) that the production of the red colour is due to the formation of



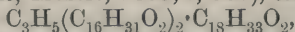
a thio-derivative, and its disappearance on exposure to sunlight to the loss of sulphur and polymerisation of the product formed.

T. A. H.

**Detection of Cotton-seed Oil in Olive Oil.** E. MILLIAU (*Compt. rend.*, 1904, **139**, 807—809. Compare Abstr., 1904, ii, 456).—The chemical tests applied in the detection of cotton-seed oil, namely, the reduction of warm alcoholic silver nitrate solution and the production of a red colour on treatment with a solution of sulphur in carbon disulphide, are both given by "capoc" oil and baobab oil. These oils are, indeed, more sensitive towards both reagents than cotton-seed oil, and a method of distinguishing the two former from cotton-seed oil is based on the observation that the fatty acids from "capoc" oil and baobab oil give an intense brown coloration with alcoholic silver nitrate in the cold, whilst cotton-seed oil in similar circumstances has no reducing action. The oils themselves, if chloroform is added to bring them into solution, may be used instead of the free acids, but the difference of behaviour is less marked.

H. M. D.

**Fat of the Fruits of the Dipterocarpus Species.** ISIDOR KLIMONT (*Monatsh.*, 1904, **25**, 929—932).—A specimen of Borneo tallow, from the Austrian *Handelsmuseum*, melts at 34·5—34·7° and has an acid number 15·8, an iodine number 30·1, and a hydrolysis number 194·6. It contains tristearin, tripalmitin (?), oleodistearin (Henriques and Künne, Abstr., 1899, i, 330), *oleodipalmitin*,



which melts, when freshly recrystallised, at 33—34°, when fused and resolidified at 28—29°, has an iodine number 30·2, a hydrolysis number 202·7, and other mixed glycerides of fatty acids with smaller carbon nuclei, and with unsaturated fatty acids.

Oleodipalmitin is found also in cacao fat (compare Fritzweiler, Abstr., 1902, ii, 470).

G. Y.

**Assay of Beeswax.** GEORG BUCHNER (*Chem. Zeit.*, 1905, **29**, 32—33).—A slight modification of the author's process (Abstr., 1892, ii, 665). After determining the acidity number of 3·6 grams of the sample, 35 c.c. of *N*/2 alcoholic potassium hydroxide are added, and, after connecting the Erlenmeyer flask with a Soxhlet tube and condenser, the contents are boiled briskly for one hour. In this way the liquid in the flask gets temporarily concentrated and the saponification is more complete; a portion of the alcohol also can be recovered from the Soxhlet tube. When very refractory samples have to be tested, the author uses absolute alcohol or pure amyl alcohol (Werder's process).

L. DE K.

**Saponification Number and Dry Residue of Oil of Lemon.** ENRICO BERTÉ (*Chem. Centr.*, 1904, ii, 1670; from *Boll. Chim. Farm.*, **43**, 709—713).—Adulteration of oil of lemon may be detected by means of the saponification number and by the amount of residue left on evaporation on the water-bath. The saponification number of the pure oil does not exceed 3·5, and the residue varies

from 2—3·5; it is therefore possible to detect the presence of excessive quantities of fatty or resinous matters.

A table is also given showing the constants of a pure oil; of a mixture containing 25 per cent. of terpene and 2 per cent. of fatty oil, and another mixture containing 50 per cent. of terpene and 4 per cent. of oil. The data include the rotation at 20°, the rotation of the distillate at 20°, the rotation of the residue at 20°, sp. gr. at 15°, dry residue, and the citral.

L. DE K.

**Detection of Saccharin.** E. VON MAHLER (*Chem. Zeit.*, 1905, 29, 32).—The ethereal solution containing the saccharin is evaporated to dryness and the residue is transferred to a small reduction tube, in which a small piece of metallic sodium or potassium has been placed. The whole is heated, and, after the action is over the tube while still hot is immersed in a freshly-prepared solution of sodium nitroprusside. If saccharin was originally present, the mass now contains alkali sulphide, which gives the characteristic violet colour.

L. DE K.

**The Pyrrole Reaction.** CARL NEUBERG (*Chem. Centr.*, 1904, ii, 1435—1437; from *Festschr. für Ernst Salkowski*, 271—278).—A table containing the names of 47 organic compounds which give the pyrrole reaction either directly or after addition of zinc dust or zinc dust and ammonia.

L. DE K.

**Reactions of Cocaine and Morphine.** C. REICHARD (*Chem. Centr.*, 1904, ii, 1257; from *Pharm. Zeit.*, 49, 855. Compare *Abstr.*, 1904, ii, 374).—A 1 per cent. solution of uranium nitrate containing a few drops of potassium thiocyanate gives an intensely yellow precipitate with salts of cocaine. If a little of a mixture of 5·04 parts of uranium nitrate and 6·58 parts of potassium ferricyanide is dissolved in a few drops of water and added to a few crystals of a cocaine salt, the latter assume a dark colour and gradually yield a dark brown liquid. Morphine crystals at once turn brownish-black and yield a dark red liquid which, on drying, gives an almost black residue. A mixture of 2·5 parts of crystallised copper sulphate and 6·6 parts of potassium ferricyanide rubbed with a few drops of water and a little solid or dissolved morphine at once turns dark brown. Cocaine gives no reaction. A mixture of powdered copper sulphate and morphine when heated with sulphuric acid yields a beautiful dark violet liquid.

L. DE K.

**Composition of Turmeric.** ALBERT E. LEACH (*J. Amer. Chem. Soc.*, 1904, 26, 1210—1211).—The author has analysed three varieties of turmeric, China, Pubna, and Alleppi. The average composition is as follows:

Moisture, 8·73; total ash, 7·07; ash soluble in water, 5·36; total nitrogen, 1·42, equal to 8·88 proteids; total ethereal extract, 11·17; volatile ethereal extract, 3·19; alcoholic extract, 6·96; crude fibre, 5·37; reducing matters by acid method calculated as starch, 49·73; starch by diastase method, 34·21 per cent.

L. DE K.

**New Reagent for the Detection of the Colouring Matters of Blood or their Products of Decomposition.** E. RIEGLER (*Zeit. anal. Chem.*, 1904, 43, 539—544).—The two absorption bands in the spectrum of an alkaline solution of Hoppe-Seyler's hæmochromogen are exhibited with great intensity by an alcoholic solution, and such a solution is very readily obtained by treating blood pigments with an alkaline alcoholic solution of hydrazine. Sodium hydroxide, 10 grams, and hydrazine sulphate, 5 grams, are dissolved in 100 c.c. of water and the solution is mixed with 100 c.c. of strong alcohol and filtered. By shaking a little blood or hæmoglobin with this reagent, a rich purple solution of hæmochromogen is obtained. When shaken with air, this solution becomes transiently green, and in this condition shows the single band of an alkaline hæmatin solution. In testing urine for blood, a trace of white of egg is added and coagulated by boiling after adding a drop of acetic acid. The albumin carries down the hæmatin, and after collection on a filter and washing, is shaken with the hydrazine reagent. Blood stains on linen can be treated directly with the reagent and examined with a micro-spectroscope.

M. J. S.

**Simulation of Traces of Albumin by Substances which interfere with the Ferrocyanide Test, especially in Liquids requiring Clarification.** BRUNO BARDACH (*Zeit. anal. Chem.*, 1904, 43, 554—557).—In cases where proteids have been precipitated by ammonium sulphate, it is customary to confirm the completeness of the precipitation by testing the filtrate with potassium ferrocyanide. In these circumstances, a trifling turbidity is always observed, and this the author has traced to impurities in the ammonium sulphate, which cannot be removed by any of the ordinary methods of purification. It is necessary, therefore, to employ the purest ammonium sulphate obtainable, and to test the specimen with ferrocyanide and make allowance for the turbidity which is obtained in the absence of albumin. A similar deceptive turbidity is produced by ferrocyanide in liquids which have been clarified by infusorial earth, in consequence of traces of iron from the kieselguhr passing into solution. Neither ignition nor treatment with hydrochloric acid improves the kieselguhr in this respect. The only satisfactory method of clarification is to pass the liquid through several thicknesses of filter-paper, which, however, must be absolutely free from iron.

M. J. S.

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## General and Physical Chemistry.

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**Refractive Indices of the Elements.** CLIVE CUTHBERTSON (*Proc. Roy. Soc.*, 1904, **74**, 283—284).—Attention has been previously drawn to the fact that the refractivities of (1) helium, neon, argon, krypton, and xenon, (2) chlorine, bromine, and iodine are in the ratio of small integers. With a Jamin's refractometer, adapted for high temperatures, the refractivities of mercury, phosphorus, and sulphur have been determined, and it is shown that the simple relationship found in the cases of the inert atmospheric gases and of the halogens holds also in the case of (1) nitrogen and phosphorus, (2) oxygen and sulphur; an atom of the second element in each case retards light four times as much as an atom of the first. On these lines, one may regard the two series N, O, F, Ne and P, S, Cl, A as in some sense homologous. In the latter series, the power to retard light increases with the valency, in spite of the simultaneous decrease in atomic weight. The same relationship is found for the series Ne, O, N. J. C. P.

**Spectra of the Metals in the Electric Arc. VII. Spectrum of Tungsten.** BERNHARD HASSELBERG (*K. Svenska Vet. Akad. Handl.*, 1904, **38**, No. 5, 1—47. Compare Abstr., 1903, ii, 706).—Although on the whole the same lines occur in the arc spectrum of tungsten as appear in the spark spectrum recently recorded by Exner and Haschek, there is very marked difference in the relative intensity of the lines. The lines in the arc spectrum, which are apparently due to iron, chromium, titanium, cobalt, nickel, manganese, vanadium, and molybdenum, have been eliminated, and the lines regarded by the author as characteristic of tungsten are fully recorded, the discussion being illustrated by reproductions of the spectra. A number of lines in the tungsten spectrum coincide with feeble lines in the solar spectrum, and the author regards it as proved that tungsten is present in the absorbing envelope of the sun. J. C. P.

**The Group IV. Lines of Silicon.** Sir J. NORMAN LOCKYER and F. E. BAXANDALL (*Proc. Roy. Soc.*, 1904, **74**, 296—298).—In previous papers (Abstr., 1900, ii, 181; *Proc. Roy. Soc.*, **67**, 403), it was shown that the silicon lines might be divided into four distinctive groups. The genuineness of the lines of the fourth group has been questioned by de Gramont (Abstr., 1904, ii, 641), but the authors adhere to the conclusion previously reached, and the photographic evidence on which it was based is now reproduced. J. C. P.

**Infra-red Absorption Spectrum of Carbon Dioxide as affected by Pressure.** CLEMENS SCHAEFER (*Ann. Physik.*, 1905, [iv], **16**, 93—105).—Under high pressure, the bands are widened and the maximum absorption is intensified. This result cannot be attained merely by increasing the thickness of the absorbing layer,

hence the character of the absorption depends not on the number of absorbing molecules, but on their density. J. C. P.

**Rotation of Optically Active Substances.** PAUL WALDEN (*Ber.*, 1905, 38, 345—409).—A lecture delivered before the German Chemical Society. C. H. D.

**Dissociation of Strychnine Salts determined by their Rotatory Power. Rotatory Power in Homologous Series. Influence of the Double Linking.** JULES MINGUIN (*Compt. rend.*, 1905, 140, 243—245).—The author has measured the rotation of a number of strychnine salts, obtained by dissolving 0.334 gram of strychnine and a molecular proportion of the acid in 25 c.c. of a mixture of parts of benzyl alcohol and ethyl alcohol (2:1), and the change in the rotatory power caused by the addition of excess of acid has also been studied. The results show (1) that the salts are partially hydrolysed by the addition of excess of acid, and the hydrolysis, as measured by the increase in the rotatory power, is greater in the case of the weak than of the strong acids; (2) that the salts of a homologous series of acids have practically the same rotatory power (compare Tschugaeff, *Abstr.*, 1898, i, 274, 495; 1899, ii, 3; and Minguin and de Bollement, *Abstr.*, 1903, i, 352); (3) that the salts of the unsaturated acids have a higher rotatory power than those of the saturated acids containing the same number of carbon atoms (compare Haller, *Abstr.*, 1903, i, 503, 563, 628; Zelinsky, *Abstr.*, 1902, i, 597; Rupe, *Abstr.*, 1903, i, 565; Minguin, 1903, i, 428).

M. A. W.

**Specific Rotatory Power of Nicotine dissolved in Mixtures of Water and Ethyl Alcohol.** T. GNESOTTO and G. CRESTANI (*Nuovo Cim.*, 1904, [v], 8, 365—381).—The authors have measured the specific rotation of nicotine in various mixtures of water and ethyl alcohol, all the solutions having approximately the same concentration, namely, 12.1 grams of nicotine per 100 c.c. of the solution. The results, which are given in the form both of tables and of curves, show that the values of the specific rotatory power of nicotine at 20° in aqueous alcohol are all inferior to those of the specific rotatory power of the substance itself, supposing that each component of the mixture exercises on the active substance an influence proportional to the quantity by weight in which it occurs in the mixture. The differences,  $\Delta$ , between the absolute values of the specific rotatory power of nicotine determined experimentally and the absolute values calculated on the above supposition, starting from an alcoholic solution of nicotine, increase rapidly with the amount of water substituted for alcohol, and reach a maximum for a mixture of water and alcohol containing about 80 per cent. of the latter; from this maximum point, the differences vary practically rectilinearly with the proportion of water present. From these and previous results, it is concluded that the action of mixtures of water and alcohol on alkaloids shows itself by producing an increase or a diminution in the specific rotatory power of the active substance in solution (with reference to that obtained by

calculation from the additive formula), according as dilution of the solution of the substance in the two separate solvents produces an increase or a diminution in the specific rotatory power. T. H. P.

**Fluorescence of Sodium Vapour.** L. PUCCIANI (*Atti R. Accad. Lincei*, 1904, [v], 13, ii, 433—440).—The author shows that the lines  $D_1$  and  $D_2$  exist in the fluorescence spectrum of sodium vapour. The exciting light from which they originate is that of these usually broad lines themselves, but in the small spectral interval occupied by each of them light of a given wave-length can excite the emission of waves of different lengths. Indications are given of the construction of a model of the phenomenon on the basis of secondary waves, taking into account the annulment or collision of the vibrations.

T. H. P.

**Solvent and Fluorescence.** HUGO KAUFFMANN and ALFRED BEISSWENGER (*Zeit. physikal. Chem.*, 1904, 50, 350—354. Compare Abstr., 1904, ii, 528).—An example of the way in which fluorescent amines exhibit a different fluorescence colour according to the solvent in which they are dissolved has already been given (*loc. cit.*). The same phenomenon is exhibited in an exceptional degree by dimethylnaphtheurhodine, also by *o*-aminocinnamic acid and its esters, dimethylaminodiphenylquinoxaline, aminobenzoxazole, and ethyl succinylsuccinate (compare also Kehrmann and Messinger, Abstr., 1892, 889).

It appears that dissociating solvents affect very slightly the fluorescence colour of the solid substance, but the cause of the change of fluorescence cannot be association in benzene and similar solvents, because dimethylaminodiphenylquinoxaline, for example, has a normal molecular weight in benzene. It is shown, however, that in general the displacement of the fluorescence colour from that exhibited by the solid increases as the dielectric constant of the solvent decreases. The order of the solvents is, however, not always the same, so that the nature of the fluorescent substance is also a determining factor.

It is noted that the colour of the solutions of these fluorescent substances changes with the solvent in a manner very similar to the fluorescence colour.

J. C. P.

**Action of Very Low Temperatures on the Phosphorescence of Certain Sulphides.** P. LE ROUX (*Compt. rend.*, 1905, 140, 84—85, 239—241).—The diminution in the brightness of the phosphorescence of certain sulphides at low temperatures has been observed by Becquerel (Abstr., 1891, 776), Pictet (*Compt. rend.*, 1894, 119, 527), Dewar (*Chem. News*, 1894), Henry (*Compt. rend.*, 1896, 122, 662), and A. and L. Lumière (*ibid.*, 1899, 125, 549), and the author finds that at the temperature of liquid air phosphorescent calcium sulphide becomes non-luminous, but recovers its original luminosity when removed from the liquid air and allowed to regain the ordinary temperature. At the low temperature, the phosphorescence is in a potential state, for the light emitted by the cooled sulphide on regaining the ordinary temperature is more intense than that of a similar specimen which has not been cooled; further, if a



non-luminous specimen of calcium sulphide is placed in liquid air and exposed to the light of burning magnesium, it becomes luminous when heated to the ordinary temperature.

M. A. W.

**Triboluminescence.** II. L. A. TSCHUGAEFF (*J. Russ. Phys. Chem. Soc.*, 1904, **36**, 1245—1253. Compare Abstr., 1901, ii, 489).—The author has examined a number of crystalline compounds and finds that, in addition to the six compounds already given (*loc. cit.*), benzoyl- $\beta$ -naphthylamine and benzoyl-*m*-toluidine also exhibit triboluminescence of the first order. With the former of these two compounds, this property can be observed in ordinary daylight, and, under favourable conditions, the emission of light continues for some six or eight seconds.

The results obtained with a number of amino-compounds show that in many cases of two closely-related compounds, such as homologues or isomerides, one exhibits triboluminescence whilst the other does not. Similar observations have been made on other classes of compounds.

Triphenylmethane is triboluminescent, but its compounds with benzene or thiophen of crystallisation do not exhibit this property; on heating these compounds for a short time above their melting points and recrystallising the residues from ether or toluene, triboluminescent crystals are again obtained.

Aniline hydrochloride exhibits strong triboluminescence, but the basic salt,  $2\text{NH}_2\text{Ph}\cdot\text{HCl}$ , does not do so. Uranium nitrate completely loses its power of triboluminescence if the crystals are recrystallised from ethereal solution over phosphoric oxide.

A number of optically active compounds were examined, and it was found that these exhibit triboluminescence, whilst the corresponding racemic compounds do not.

T. H. P.

**Radioactivity of Underground Air.** H. M. DADOURIAN (*Amer. J. Sci.*, 1905, [iv], **19**, 16—22).—Bumstead has recently shown (*Amer. J. Sci.*, 1904, **18**, 1) that the excited activity obtained by exposing a negatively charged wire in the open air may be fairly accounted for by assuming the presence of radium and thorium emanations in the air. The author now finds that the slowly decaying activity obtained by exposing a negatively charged wire to underground air (that is, air which has passed through the soil) is attributable to thorium.

J. C. P.

**Occurrence of Radium and of Radioactive Noble Earths in Fango Mud and Soil from Capri.** FRIEDRICH GIESEL (*Ber.*, 1905, **38**, 132—133).—The small amount of crude barium sulphate obtained from Fango mud contains radium. As Capri soil contains no sulphuric acid, it was fractionally extracted with hydrochloric acid; radium was found to be present chiefly in the fraction obtained by extraction of the earth with a large excess of hydrochloric acid. No uranium was found in either earth.

G. Y.

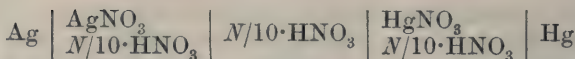
**A New Radium Mineral.** J. DANNE (*Compt. rend.*, 1905, 140, 241—243).—The pyromorphite in lead ores found at Issy-l'Évêque contains radium in variable quantity, some specimens having a radioactivity several times as great as that of uranium, and 1000 kilos. of the mineral yield one centigram of radium bromide. As the mineral contains no uranium (compare Boltwood, *Abstr.*, 1904, ii, 666), the radium has probably been recently deposited by waters charged with radium salts, for from the waters of springs in the neighbourhood a radioactive gas containing radium emanation has been extracted, and the barium sulphate precipitated by sulphuric acid from a solution of barium chloride in the radioactive water has a permanent, although feeble, radioactivity. M. A. W.

**Potential of the Hydrogen-oxygen Cell.** FRANCIS JOSEPH BRISLEE (*Trans. Faraday Soc.*, 1905, 1, 65—74. Compare Wilsmore, 1901, ii, 2; Luther and Inglis, 1903, ii, 406).—The influence of small quantities of hydrogen peroxide, persulphuric acid, and ozone on the oxygen potential has been investigated. Two different methods of operation were employed. In the first, the electrodes were polarised by electrolysis extending over two to three days, in the second they were freed from gases as completely as possible to begin with, and the respective gases were then passed through the solution (normal acid or alkali), the potential, as in the first method, being measured at intervals until a constant value was reached. This condition having been attained, the effect of the addition of the various substances was tried.

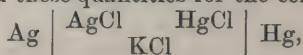
The oxygen potential is lowered by the addition of small quantities of hydrogen peroxide. The presence of persulphuric acid or ozone raises the oxygen potential. In one experiment, in which the concentration of the added persulphate was 1 gram-molecule in 5000 litres, the *E.M.F.* rose from 1.081 to 1.122 volts, and remained constant at this value for five days. Persulphuric acid and ozone appear further to hinder the separation of oxygen from the supersaturated electrodes, and this perhaps accounts for the high potential observed and maintained for a comparatively long period in electrolytically polarised electrodes. A very thin platinum electrode was prepared by coating a glass tube with "Glanz Platin," heating in a muffle furnace, and platinising in the usual way. When this was polarised for 72 hours in normal sodium hydroxide solution, the original *E.M.F.* of the cell was 1.366, but on passing a current of oxygen gas through the solution this rapidly fell to 1.073 (the normal value). Under the same conditions, but with the addition of potassium persulphate (1 gram-molecule in 500 litres), after polarisation, the original *E.M.F.* of 1.350 volts only sank to 1.328 volts at the end of ten days.

The *E.M.F.* of cells provided with very thin platinised electrodes prepared in the manner described is in very good agreement with that calculated from the Helmholtz formula. H. M. D.

**Reduction of Mercurous Chloride by Silver.** J. N. BRONSTED (*Zeit. physikal. Chem.*, 1904, 50, 481—486).—As shown by Ogg (*Abstr.*, 1899, ii, 14), the potential difference of the cell



alters its sign with the concentration of the silver and mercurous salts, and in the most dilute solutions studied by him the current passed in the cell from silver to mercury. This must therefore be the case also with the cell  $\text{Ag} \left| \frac{\text{AgCl}}{\text{KCl}} \frac{\text{HgCl}}{\text{KCl}} \right| \text{Hg}$ , and the change going on in this cell may be represented by the equation  $\text{Ag} + \text{HgCl} = \text{Hg} + \text{AgCl}$ . This, however, is an endothermic reaction, for, according to the work of Thomsen and of Nernst, the heat of formation of mercurous chloride is greater than that of silver chloride. With the help of Helmholtz's equation,  $T(d\pi/dT) = \pi - U$ , the heat effect of the reaction may be calculated from the *E.M.F.* and the temperature-coefficient of the *E.M.F.* of the corresponding cell. The author has determined these quantities for the cell



and is able to calculate the heat absorbed by the reaction  $\text{Ag} + \text{HgCl} = \text{Hg} + \text{AgCl}$  in good agreement with the calorimetric data.

J. C. P.

**The Measurement of the Potential of the Electrodes in Stationary Liquids. The Determination of Changes of Concentration at the Cathode during Electrolysis.** HENRY J. S. SAND (*Trans. Faraday Soc.*, 1905, 1, 1—23. Compare Abstr., 1901, ii, 82).—In the cells used for the measurement of the electrode potentials, arrangements were made to have the electrode not under examination as non-polarisable as possible, to avoid the evolution of gases and to permit of the continuous measurement of the difference of potential between the electrode and the layer of solution in contact with it during the passage of the current. The variation of the electrode potential with the time of passage of the current is shown in a series of curves.

With solutions of silver nitrate, copper sulphate, and zinc sulphate, the removal of the dissolved substance from the immediate neighbourhood of the cathode is indicated by a sudden drop in the electrode potential. In the case of copper sulphate, the fall amounts to one volt, and the potential then becomes fairly constant at this lower value. In the case of silver nitrate, the fall is only about 0.2 volt, and afterwards the potential rises more or less rapidly to its original value, the cathode being then found to have become covered with minute silver crystals which grow out into the solution. Zinc sulphate behaves in similar manner to copper sulphate. Diffusion coefficients for the first two salts are calculated on the assumption that the breaks in the curves may be taken as measuring the time which elapses before the concentration of the liquid bathing the electrode becomes zero, and the numbers obtained agree satisfactorily with the known data.

Curves obtained for alcoholic cuprous chloride solutions show two breaks, one corresponding with the reduction of the small quantities of contained cupric salt, the other to the deposition of copper from the cuprous chloride; the latter process begins at 0.45 volt, the electrode



potential rising, however, gradually to 0.65—0.70 volt, at which it remains fairly constant.

The curves for the electrode potential when nitrobenzene is undergoing reduction in acid and alkaline solutions are also given. In acid solution and with a platinum cathode, the potential rises at first, then falls, and again rises, becoming finally stationary. The retrogression appears to be due to temporary alteration in the nature of the electrode as a consequence of the electrolysis. With a copper cathode, similar phenomena are observable, but whilst the original electrode potential has a lower value (corresponding with less absorption of energy), the final stationary potential is higher than for the platinum cathode on account of the higher "over-voltage" necessary to liberate hydrogen.

According to calculations made by the author, the variations of electrode potential with current density observed by Haber (compare Abstr., 1900, i, 281; Russ, Abstr., 1903, ii, 631) cannot be explained as the result of concentration changes at the cathode. H. M. D.

**Anodic P.D.-Current Curve for Hydrochloric Acid at Platinum Electrodes.** ROBERT LUTHER and FRANCIS J. BRISLEE (*Zeit. physikal. Chem.*, 1905, 50, 595—601. Compare Abstr., 1903, ii, 708).—A reply to Bose's criticism (Abstr., 1904, ii, 697). J. C. P.

**Electrical Conductivity of Ethereal Solutions of Phosphoric Acid.** WLADIMIR A. PLOTNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1904, 37, 1282—1288).—Ethereal solutions of phosphoric acid possess considerable conductivity. An aqueous 87 per cent. solution of the acid has only three times as great a conductivity as the ethereal solution of corresponding concentration; at higher concentrations, the difference becomes still less. With diminution of the concentration, the conductivity in ethereal solution falls much more rapidly than in aqueous solutions. A similar rapid fall in conductivity is observed on diluting other non-aqueous solutions, and it remains an open question what concentration should be employed in estimating the dissociating power of a solvent. The molecular conductivity diminishes continuously as the concentration diminishes. With rise of temperature, the specific conductivity increases. The considerable development of heat occurring on dissolving phosphoric acid in ether and transforming the 90 per cent. solution to the crystalline condition at 25° may be an indirect indication of the existence of a chemical compound of ether with phosphoric acid. T. H. P.

**Electrical Conductivity and other Properties of Sodium Hydroxide in Aqueous Solution, as elucidating the Mechanism of Conduction.** WILLIAM ROBERT BOUSFIELD and THOMAS M. LOWRY (*Proc. Roy. Soc.*, 1904, 74, 280—283).—The conductivity of sodium hydroxide solutions, touched on in an earlier paper (Abstr., 1903, ii, 52), has been further studied. The conductivity-temperature curve exhibits an inflection (see *loc. cit.*) between 0° and 100° only in the case of solutions which are moderately dilute. The temperature of inflection varies regularly with the sodium

hydroxide concentration, from 48° for a normal (4 per cent.) solution to 100° for a 30 per cent. solution. When the sodium hydroxide solutions are very dilute or concentrated, no inflection occurs in the conductivity-temperature curve, and there is a marked parallelism between the change of conductivity and the change of viscosity with temperature. The inflected conductivity-temperature curves can be represented by the equation  $K_t = K_o + at + \gamma(t - T')^3$ , where  $T'$  is the temperature of inflection, but the more general formula  $K_t/K_o = \rho_t/\rho_o(1 + bt)^ne^{-at}$  is applicable to conductivity-temperature curves of all kinds. With the help of this formula, it is possible to make some approximation to resolving the two opposing influences (decay of ionisation and increase of ionic mobility with rising temperature) which determine the form of the conductivity-temperature curve.

The conductivity-concentration curve for sodium hydroxide solutions at 18° is similar to that given by Kohlrausch. The maximum conductivity at this temperature is 0.3490 (Kohlrausch's value = 0.3462) in a 15 per cent. solution. At higher temperatures the maximum conductivity is greater, rising to 1.4 at 100°, and occurs in more concentrated solutions.

The densities of sodium hydroxide solutions of different concentrations have been very carefully determined, the plan being to start from a large weighed quantity of sodium and to convert this quantitatively into the hydroxide. Eleven determinations, made with six different standard solutions, gave as the density of a 50 per cent. solution the value 1.5268, with an average error of 0.0001. The other solutions, the densities of which were to be determined, were prepared by diluting the strong standard solution. Such a density-concentration table having been drawn up, it is possible to deduce the concentration of any given sodium hydroxide solution more accurately from its density than from a titration of the solution. The variation of density with temperature becomes simpler in character as the concentration of the solution studied increases. Thus, when the equation  $\rho_t = \rho_o + at + \beta t^2 + \gamma t^3$  is taken to represent the influence of temperature on the density of water and aqueous sodium hydroxide solutions,  $\gamma$  vanishes when the concentration of 12 per cent. of alkali is reached, and  $\beta$  vanishes at 42 per cent. concentration.

The viscosity of a 50 per cent. sodium hydroxide solution is about 70 times that of water. The influence of this factor on the ionic mobility may be to some extent eliminated by dealing with the ratio of molecular conductivity to fluidity. The molecular conductivity of sodium hydroxide solutions decreases with increasing concentration, but the foregoing ratio, termed the "intrinsic conductivity," falls to a minimum at about 8 per cent. sodium hydroxide and then rises, attaining at 50 per cent. concentration a value considerably greater than that found for the most dilute solutions. This is associated with the fact that liquid caustic soda is an electrolyte, and in concentrated solutions the caustic soda probably conveys the current partly as such.

The molecular volume of sodium hydroxide in dilute aqueous solution has a large negative value, a litre of water dissolving 140 grams at 0°, 100 grams at 18°, or 60 grams at 50°, without

increasing in volume. The molecular volume does not increase continuously with rising temperature, but reaches a maximum at about 70°. In a 50 per cent. solution, however, the temperature has little effect on the molecular volume.

J. C. P.

**Electrolysis with Alternating Currents. Passivity of Metals.** MAX LE BLANC (*Zeit. Elektrochem.*, 1905, 11, 8—10).—Remarks on papers by Brochet and Petit (this vol., ii, 27) and by Sackur (*Abstr.*, 1904, ii, 802).

T. E.

**Electrolysis with Alternating Current.** CARLO ROSSI (*Chem. Centr.*, 1905, i, 61; from *L'Indust. Chim.*, 1904, 6, 333—335. Compare Le Blanc and Schick, *Abstr.*, 1904, ii, 229).—Solutions of potassium chlorate acidified with sulphuric acid exhibit complicated phenomena when subjected to the action of an alternating current between copper or iron electrodes. The copper electrodes become coated with cuprous chloride, copper dissolves, and a bluish-green basic chlorate,  $\text{Cu}(\text{ClO}_3)_2 \cdot 3\text{Cu}(\text{OH})_2$ , separates from the solution. When a direct current is used, cuprous chloride is formed at the anode, together with smaller quantities of basic chlorate and chloride; the solution, from which a complex mixture of cupric hydroxide, cupric oxide, copper, and cupric chloride separates out, does not contain dissolved copper. It is supposed that the copper passes into solution at the anode as cuprous ion, which reduces the chlorate, cupric copper being then precipitated by the alkali formed at the cathode. The non-reversibility of the change at the electrodes when alternating currents are used is probably due to the rapid removal of the cuprous ions in this manner. When, on the other hand, the potassium chlorate is replaced by sodium chloride, the alternating current dissolves very little copper. With iron electrodes, similar phenomena were observed.

H. M. D.

**Determination of the Electrochemical Equivalent of Silver.** G. VAN DIJK (*Arch. Néerland*, 1904, ii, 9, 447—525. Compare *Abstr.*, 1904, ii, 255).—The present paper gives detailed descriptions of the methods and apparatus employed in the determination of this constant, the substance of the results having been already published (*loc. cit.*). An investigation into the influence of the form and manipulation of the voltmeter on the value of the equivalent has also been made, and the author considers that the value of the equivalent is best represented by 0.011180.

T. A. H.

**Electrolytic Solution of Platinum.** RUDOLF RUER (*Zeit. Elektrochem.*, 1905, ii, 10—12).—The author considers that his theory of the dissolution of platinum by alternating currents (*Abstr.*, 1903, ii, 407) gives a much more satisfactory explanation of the phenomena than that advanced by Brochet and Petit (this vol., ii, 27 and 28). Several new experiments are described in which platinum anodes are polarised for a few seconds and then left exposed to a solution of sulphuric acid containing ferrous sulphate or sulphur dioxide for a few



seconds. Considerable quantities of platinum are dissolved, which would be quite inexplicable on the theory of Brochet and Petit, but is quite in accordance with that of the author.

T. E.

**Theory of Amphoteric Electrolytes. II.** JAMES WALKER (*Proc. Roy. Soc.*, 1904, 74, 271—280).—The correction of a slight error in the calculations of the earlier paper (*Abstr.*, 1904, ii, 309) leads to a still better agreement between the theoretical and experimental values of the conductivity for the aminobenzoic acids.

Formulae are deduced connecting the concentrations of the various components in the solution of an amphoteric electrolyte which is largely ionised. From a consideration of these formulae, it appears that the non-ionised proportion is unaffected by a simultaneous change of  $1/k_a$ ,  $k_b$ , and  $v$  in the same ratio [ $k_a$  = dissociation constant of the electrolyte as acid,  $k_b$  = dissociation constant of the electrolyte as base,  $v$  = dilution]. This result is of importance in dealing with any series of amphoteric electrolytes for which the product  $k_a \cdot k_b$  is a constant. Here it may be shown that as  $k_a$  diminishes and  $k_b$  increases, the total ionisation falls off rapidly at first, then more slowly, until over a considerable range it is practically constant at the minimum value actually reached when  $k_a = k_b$ . The further increase of  $k_b$  and decrease of  $k_a$  is accompanied by corresponding changes in the ionisation until finally the electrolyte under consideration acts really as a simple base.

The author's theory has been further tested with satisfactory results in the cases of cacodylic acid (see Johnston, *Abstr.*, 1904, i, 984) and asparagine. From Winkelblech's values of  $k_a$  and  $k_b$  for asparagine (*Abstr.*, 1901, ii, 370), the molecular conductivity at  $v = 16$  is calculated in good agreement with an actual determination, for which specially purified water and asparagine were employed.

The acidic or basic ionisation of an amphoteric electrolyte increases the freezing point depression, whereas the "saline" ionisation does not. In conjunction with the conductivity, the cryoscopic method should give useful results with soluble electrolytes which are largely ionised.

J. C. P.

**Contact Electrification and Colloidal Solutions.** JEAN PERRIN (*J. Chim. phys.*, 1904, 2, 601—651).—The phenomenon of electric osmosis was first observed by Reuss, and subsequently investigated by Wiedemann, who showed that in a given liquid the loss by electric osmosis across a diaphragm varies with the current, is proportional to the cross section of the diaphragm and independent of its thickness. In the case of capillary tubes, Quincke showed that the transference is proportional to the square of the diameter, and also showed that some substances exhibit osmosis in the reverse sense. Quincke sought to explain the phenomenon by the existence of a double electrified layer at the walls. The tangential force of the field causes motion of the liquid layer and, hence, by friction, of the inner mass of liquid also, and Helmholtz proved that this explanation was in accord with the quantitative results. This explanation also holds for the *E.M.F.* of filtration and leads to the result that if a liquid filters under pressure across a given diaphragm the *E.M.F.* is proportional to the pressure and that this ratio depends

solely on the liquid, being independent of the thickness of the diaphragm or of the diameter of its pores. From observations of either the electric osmosis or the *E.M.F.* of filtration, determination may be made of the difference of potential between the liquids and walls. Similar reasoning also explains the motion of small suspended solids in the opposite sense. In the author's own experiments, although the diaphragm was varied and the field taken to 90 volts per cm., no osmosis was observed for chloroform, ether, petroleum, benzene, turpentine, or carbon disulphide, whilst with all diaphragms and in a field of 10 volts per cm. osmosis was readily found for water, ethyl alcohol, methyl alcohol, acetone, acetylacetone, and nitrobenzene. He hence concludes that electric osmosis is only easy in the case of liquids of high specific inductive capacity, that is, for ionising liquids, whilst low viscosity is also necessary. The influence of traces of dissolved electrolytes was then investigated, and it was found that powdered carbon becomes positively charged in slightly acidified water, and negatively in water rendered feebly alkaline. Similar results were obtained when anhydrous chromium chloride and other insoluble solids were used in place of carbon. The results are sometimes masked by a slight solubility of the compounds employed, but the results indicate the following general rule. The potential of any wall in an aqueous solution is always raised by the addition of a univalent acid to the solution and lowered by the addition of a univalent base. This influence is ascribed to the hydrogen and hydroxyl ions, other univalent ions having comparatively little influence. The great effect of these ions may possibly be due to a small diameter or sphere of molecular attraction. Polyvalent ions appear to diminish the electrification, the addition of sulphuric acid lowering the effect due to hydrochloric or nitric acids. The result is still more marked with trivalent or quadrivalent acids. This action may occasionally be of service in indicating the existence of polyvalent ions in solution. It seems probable also that a study of the laws of contact electrification may provide a means for evading or inducing the dragging down of soluble matter by precipitates.

L. M. J.

**Recent Investigations bearing on the Theory of Electrolytic Dissociation.** LOUIS KAHLBERG (*Trans. Faraday Soc.*, 1905, 1, 42—53).—Experimental observations made by the author in connection with the properties of aqueous and non-aqueous solutions are summarised. Their bearing on the theory of solution and of electrolytic dissociation is discussed, and the conclusion is drawn that these theories are untenable.

No general agreement between the values of electrolytic dissociation as calculated from the conductivity, and from the vapour pressure, boiling point, or freezing point, has ever been established. Whereas Arrhenius's theory requires that the molecular conductivity shall always increase with dilution, cases are known where it diminishes or remains practically constant. The Nernst-Thomson rule, which ascribes the cause of dissociation to the high specific inductive capacity of the solvent, is not confirmed by later experiments.

The additive properties of solutions of electrolytes, which are

frequently regarded as evidence in favour of the dissociation theory, really form no argument, for in the case of pure liquids additive relationships are known to exist, for example, in the case of molecular volume and of molecular refractive power.

The theory refers the colours of solutions, say, of copper, nickel, and cobalt salts, to the ions, but non-conducting benzene solutions of the oleates of these metals are also blue, green, and red respectively, and the red cobalt solution turns blue on heating, just like the aqueous solutions.

Instantaneous reactions cannot be ascribed to ions, for non-conducting benzene solutions of hydrochloric acid and of copper oleate precipitate copper chloride practically instantaneously.

The behaviour of acids towards metals in non-aqueous solutions is not in accord with the assumption that the substances owe their characteristic properties to hydrogen ions, for non-conducting solutions of trichloroacetic acid in allylthiocarbimide attack dry magnesium rapidly and decompose the dry alkali carbonates.

Thermal data offer difficulties also, and the fact that Ostwald's dilution law holds good for certain organic acids in aqueous solutions is not of general significance. The essential electrolytes do not fit in with the law of mass action in aqueous solution, and in non-aqueous solvents it has yet to be shown that the mass action law is applicable. These and other facts lead the author to conclude that Arrhenius's dissociation theory is useless and misleading.

An acceptable theory of solution must not differentiate between the processes of solution and chemical action. A careful consideration of facts shows that these are "identical in character, and chemical compounds are merely the cleavage pieces of solutions placed under special stress or duress represented by the so-called purifying processes." The process of solution thus represents the general case of interaction of substances, union resulting when the specific attraction between them is, under the existing conditions, sufficient to cause a fusion or blending of their masses. In the further investigation of solutions, the most concentrated should receive first consideration, the dilute solutions only appearing as limiting cases. By means of vapour pressure, freezing point, and conductivity measurements carried out systematically on these lines, it should be possible to elaborate a theory of solutions on the basis of chemical affinity acting between solvent and solute.

H. M. D.

**Ionisation in Flames.** PIERRE MASSOULIER (*Compt. rend.*, 1905, 140, 234—236).—Using the flame of burning ether instead of coal gas, the author has measured the conductivity of a flame by Townsend's method (compare *Abstr.*, 1901, ii, 221) at a lower temperature than that employed by Wilson (*Abstr.*, 1899, ii, 722) or Moreau (*Abstr.*, 1903, ii, 125, 196), and finds, contrary to the experience of these investigators, that the electrodes play only a secondary part in the experiment. Experiments are in progress to determine if the ionisation which is the cause of the conductivity of the flame is of chemical origin or merely due to the dissociation of the molecules at the high temperature.

M. A. W.



**The Ions of the Atmosphere.** P. LANGEVIN (*Compt. rend.*, 1905, 140, 232—234).—The author has extended his investigations on ionised gases (compare Abstr., 1902, ii, 301; 1903, ii, 263, 587) to the ions in the atmosphere at the top of the Eiffel Tower and finds that in addition to the ordinary ions having a mobility of 1.5 cm. for one volt per centimetre there are others having a mobility several thousand times smaller, and of the same order as those observed by Townsend in freshly prepared gases (Abstr., 1901, ii, 221) and by Bloch in the ions of phosphorus (Abstr., 1903, ii, 206; 1904, ii, 117; this vol., ii, 72); but the electric charge of the latter ions is fifty times as great as that of the ordinary ions.

M. A. W.

**Registration of the Ions in the Atmosphere.** P. LANGEVIN and M. MOULIN (*Compt. rend.*, 1905, 140, 305—307).—An arrangement for the automatic registration of the ionic condition of the atmosphere is described. By means of a small water turbine or electro-motor, a current of air is made to pass through a cylindrical condenser charged to constant potential, an electrode within the cylinder being connected with one of the quadrant pairs of a Curie electrometer. The air then passes through a meter, or anemometer, which sets in action a clockwork mechanism at intervals corresponding with the passage of a definite volume of air through the apparatus. For a description of the mechanical arrangements, by means of which this apparatus makes it possible to have the concentration of both positive and negative ions recorded automatically two or three times per hour, the original must be consulted.

H. M. D.

**Cause of the Ionisation of Air in Contact with Phosphorus.** EDGAR MEYER and ERNST MÜLLER (*Chem. Centr.*, 1905, i, 61—62; from *Verh. Deut. Phys. Ges.*, 1904, 2, 332—336).—The object of these experiments was to determine whether the ionisation of the air in contact with oxidising phosphorus is due to the light emitted in the process or to the oxidation itself. In presence of substances such as chlorine, ether, and turpentine, which inhibit the glowing of phosphorus, there is no oxidation and no ionisation, so that these experiments furnish no information. If phosphorus is allowed to oxidise in thin-walled quartz vessels which are transparent to ultra-violet radiation, no ionisation of the air can be detected. Examination of the spectrum of the radiation emitted by phosphorus undergoing oxidation shows it to be free from ultra-violet rays. The ozone produced in the oxidation cannot be the cause of the enormous conductivity imparted to the air; after removal of the ozone, the air retains its conducting power.

H. M. D.

**High Temperature Measurements.** THOMAS GRAY (*J. Soc. Chem. Ind.*, 1904, 24, 1192—1197).—The author gives a description of his own experience with various types of pyrometer.

The calorimetric method, using an iron cylinder, gives results which are usually within 10° of the truth at temperatures not exceeding about 1000°.

Several forms of direct reading and registering thermo-electric

pyrometers are described; calibration is most conveniently and accurately effected by direct comparison with a standard couple, the *E.M.F.* being measured by means of a potentiometer, but it may also be carried out by means of the boiling point of sulphur, the melting point of sodium carbonate ( $852^{\circ}$ ), and that of potassium sulphate ( $1066^{\circ}$ ). Convenient methods of working are described together with the precautions needed to ensure accuracy.

The platinum resistance thermometer is more sensitive and accurate than the thermo-element, but it is more easily damaged by contact with furnace gases if its protecting porcelain tube breaks, and it is more difficult to repair and restandardise.

The Wanner optical pyrometer is described: the light from the hot substance and the light from a small incandescent lamp pass through the same train of prisms (only the red rays being used for comparison) and then through a Nicol prism. By means of a double prism and lens of special construction, the extraordinary ray corresponding with the one source of light and the ordinary ray corresponding with the other are focussed together on a slit in the eye-piece; they are therefore polarised at right angles to each other, and the rotation of a Nicol prism in the eye-piece makes it possible to diminish the brightness of one and increase that of the other until they appear of equal brightness. The temperature is then obtained from the amount of rotation required. The great advantage of a pyrometer of this form is that no part of it is exposed to the high temperature, and therefore the frequent repairs and restandardisations needed with other pyrometers are avoided. T. E.

**New Laboratory Burners and their Adaptation to the Production of High Temperatures.** GEORGES MÉKER (*Bull. Soc. chim.*, 1905, [iii], 33, 210—215).—The burners are of the usual air-gas type, but the gas enters the chimney through an injector of special form, and the chimney is capped by a network of partitions of square section. This network presents a large cooling surface and so diminishes the tendency to "strike back." At the same time, it breaks up the air-gas stream, producing a large number of small jets which unite above to form an intensely hot, homogeneous flame. A laboratory burner of this type in action is figured in the original, which also gives particulars of the temperatures obtainable with these burners working under different conditions. T. A. H.

**New Regulator for Thermostats.** OCTAVE DONY-HÉNAULT (*Zeit. Elektrochem.*, 1905, 11, 3—5).—In the well-known Ostwald form of regulator, toluene cannot be used in the bulb which is placed in the thermostat because it creeps between mercury and glass and so causes a constant rise of temperature. This is avoided by making the part of the regulator which is outside the bath in the form of a double U-tube, connecting the toluene bulb to the top of the middle bend, and placing a layer of salt solution between it and the mercury. When the temperature of the air is constant, the temperature of the thermostat varies less than  $0.001^{\circ}$ ; the influence of fluctuations of the external temperature is diminished by making the volume of the

external tubes small in comparison with that of the immersed toluene bulb.

T. E.

**Vaporisation of Solid Substances at the Ordinary Temperature.** CONSTANTIN ZENGELIS (*Zeit. physikal. Chem.*, 1904, 50, 219—224).—When silver leaf is suspended over a layer of a metallic oxide in a closed vessel, the leaf, after a longer or shorter interval, begins to assume a yellow colour, and traces of the metal originally present in the oxide may be detected in the silver. In some cases, the increase in weight of the silver can be determined. The oxides found to act in this way were those of copper, zinc, iron, chromium, manganese, lead, cobalt, uranium, molybdenum, arsenic, and antimony. The action is favoured by partial exhaustion of the containing vessel, by the presence of moisture and of a reducing substance such as hydrogen or alcohol vapour. Comparative experiments with nickel, copper, and aluminium foil led to negative results, but gold leaf exposed to zinc oxide for six months was found to contain a trace of zinc. Other substances which melt only at a high temperature may be similarly shown to vaporise at the ordinary temperature; for example, sulphur, selenium, lead, copper, red phosphorus, tin, antimony and arsenic sulphides, iron, copper, and chromium hydroxides, copper carbonate, zinc chloride, and lead iodide. That such substances vaporise may be shown also by other methods: thus, if a watch-glass containing potassium ferrocyanide solution is kept along with copper or copper oxide in a closed vessel, the ferrocyanide gradually turns to a brownish-red colour.

J. C. P.

**Molecular Weight Determination by the Rise of the Boiling Point in Cathode Ray Vacuum.** FRIEDRICH KRAFFT and PAUL LEHMANN (*Ber.*, 1905, 38, 242—253. Compare *Abstr.*, 1896, ii, 89, 464, 635; 1899, ii, 464).—In previous papers, it was established that the boiling point of high molecular liquids in the vacuum of the cathode light depended on the height of the vapour column above the liquid, and also on the molecular weight of the substance. A number of improvements have been introduced into the apparatus, for which the original should be consulted, among the most important being an arrangement allowing the thermometer to be moved so that the temperature at any position from immersion in the liquid to the very top of the column of vapour can be read at will. The work performed by each layer of vapour in raising up that over it causes an absorption of heat, so that in the case of mercury the temperature falls from 174° in the liquid to 152° at the top of the column of vapour 195 mm. high; a difference of 22°.

The difference of these two temperatures has been determined for various substances: in the case of palmitic and lauric acids and mercury, the differences observed, namely, 28.4°, 22.2°, and 22° respectively, are exactly proportional to the molecular weights. This relationship has been satisfactorily tested for a number of substances.

The method has been extended to the metals, the experiments being carried out in quartz vessels. Cadmium showed a fall of 5° for a



column of 80 mm. of vapour, zinc a fall of  $3^{\circ}$ , and lead one of  $2-3^{\circ}$ , these figures being in agreement with their molecular weights.

E. F. A.

**Lowest Temperature of Evaporation of Metals in the Vacuum of the Cathode Light.** FRIEDRICH KRAFFT and LUDWIG BERGFELD (*Ber.*, 1905, 38, 254—262. Compare Demarçay, *Compt. rend.*, 1882, 95, 183).—Attention has been paid to the accurate determination of the temperature at which metals heated in the vacuum of the cathode light first begin to evaporate. The experiments were performed in a horizontal tube 25 cm. long, connected at one end to the pump and cooled receiver, whilst the other was surrounded by a mantle in which the heating fluid was circulated; in some cases, a quartz tube was employed. In this way, the temperature of evaporation of cadmium was determined to be at  $156.5^{\circ}$ , silver at  $680^{\circ}$ , and similarly for a number of metals. For the details, the original should be consulted.

E. F. A.

**Boiling Point in Vacuum; a New Constant and its Meaning.** FRIEDRICH KRAFFT (*Ber.*, 1905, 38, 262—266. Compare preceding abstracts).—It is pointed out that mercury begins to evaporate at about  $-40^{\circ}$ , boils in vacuum at  $155^{\circ}$ , and under the ordinary pressure at  $357^{\circ}$ . The interval ( $195^{\circ}$ ) between the commencement of evaporation and the point at which the substance boils in vacuum, during which work is done in overcoming gravity, is approximately equal to that ( $202^{\circ}$ ) between the boiling point in vacuum and at the ordinary pressure, during which work is done in overcoming the pressure of the atmosphere. The same relationship holds for all the metals experimented with; as a general rule, as much heat is required, starting from the beginning of evaporation, to overcome the resistance of gravity as is further required to overcome the pressure of the atmosphere, or, in other words, gravity and atmospheric pressure are equivalent.

The results are summarised as follows, column I giving the temperature at which evaporation begins in the vacuum, column III the boiling point in the vacuum, and column V the boiling point under 760 mm. pressure.

	I.	Diff.	III.	Diff.	V.
Mercury .....	$-40^{\circ}$	$195^{\circ}$	$155^{\circ}$	202	$357^{\circ}$
Cadmium .....	156	294	450	299	749
Zinc .....	184	366	550	370	920
Potassium .....	63	302	365	302	667
Sodium .....	98	320	418	324	742
Bismuth .....	270	723	993	707	1700
Silver .....	680	680	1360	680	2040

E. F. A.

**Conductivity of Nitrogen Dioxide for Heat.** C. FELICIANI (*Chem. Centr.*, 1905, i, 331; from *Physikal. Zeit.*, 1905, 6, 20—22).—The conductivity of nitrogen dioxide was examined by the method of cooling at different pressures and temperatures ( $18^{\circ}$  to  $131^{\circ}$ ). Allowance being made for convection, there is an increase in the con-

ductivity at all pressures at  $65^\circ$ , followed by a decrease to a minimum and a second increase between  $120^\circ$  and  $130^\circ$ .

The conductivity increases with the pressure, and the conductivity and dissociation curves follow similar courses. Up to  $90^\circ$  and for pressures of not less than 60 mm., the conductivity of nitrogen dioxide is larger than that of any non-dissociating gas examined previously.

Magnanini's numbers, used by Nernst (*Boltzmann Festschrift*, 1904), are not quite trustworthy. The value for the conductivity of a mixture of  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$  cannot be taken as equal to that of  $\text{CO}_2$ , the author obtaining somewhat higher values than those calculated by Nernst.

G. D. L.

**Heats of Combustion of Atoms and Molecules.** LAWRENCE J. HENDERSON (*J. Physical Chem.*, 1905, 9, 40—56).—From consideration of the values of the heats of combustion of a number of substances, the author shows that the same substitution affects the heat of combustion to different extents. Thus, the substitution of  $\cdot\text{OH}$  for  $\cdot\text{H}$  diminishes the heat of combustion by 40 cal. when it converts a paraffin hydrocarbon into a primary alcohol, but by 72 cal. when it converts an aldehyde into an acid. These values are not, however, absolutely constant, but the differences vary in a regular way, and the author considers that every atom of a molecule, in a degree dependent upon its position, influences the heat of combustion of every other atom of the molecule, whether or not it is united to that atom.

L. M. J.

**Depression of the Freezing Point in Dilute Solutions of Highly Dissociated Electrolytes,** HANS JAHN (*Zeit. physikal. Chem.*, 1904, 50, 129—168. Compare Abstr., 1900, ii, 707; 1901, ii, 491, 592).—With an apparatus similar to that used by Hausrath (Abstr., 1903, ii, 61), the author has very carefully determined the freezing points of dilute solutions of lithium, sodium, potassium, and caesium chlorides, sodium and potassium bromides. Lithium chloride is peculiar in that the molecular depression exhibits a minimum, whilst in all the other cases the molecular depression increases regularly as the concentration decreases.  $\Delta$ , the freezing point depression, and  $N$ , the number of gram equivalents of salt in 1000 grams of water, are connected by the following equations, which give numbers in very good agreement with experiment,  $N$  having values from 0.1 downwards: (1) for potassium chloride,  $\Delta = 3.5605N - 0.98196N^2$ ; (2) for sodium chloride,  $\Delta = 3.5582N - 0.87452N^2$ ; (3) for lithium chloride,  $\Delta = 3.6116N - 0.8857N^2$ . The values for the ionic concentration ( $n_1$ ), deduced from the freezing point depression, agree very well with those deduced from the conductivity in the cases of sodium and potassium chlorides; for lithium chloride, the conductivity method gives smaller values, for caesium chloride and potassium bromide, greater values of  $n_1$ , than the freezing point method. Even sodium and potassium chlorides, however, are very far from following the formula  $n_1^2/(N - n_1) = \text{const.}$ , and the author concludes that the values of  $n_1$ , based on the validity of the simple solution laws, are wrong. He further contends that the accepted values of  $\mu_\infty$  are probably too high on account of hydrolysis

in very dilute solutions and the impurities of the water and the glass of the containing vessel. If 106.85 is taken as the value of  $\mu_{\infty}$  for sodium chloride instead of the usual 108.1, the dissociation equation given above is applicable in dilute solutions and the constant = about 0.160. A similar value is found, independent of the dilution, when  $n_1$  is deduced from the author's expanded formula for the freezing point depression (see Abstr., 1902, ii, 597). The *E.M.F.* of sodium chloride concentration cells may be calculated with the aid of the foregoing constant, and the values so found are in good agreement with experiment. Similar remarks apply to the other electrolytes studied. The attempt made in this paper to reconcile the dissociation theory with the laws of thermodynamics in the case of highly dissociated electrolytes leads, further, to the conclusion that the ionic mobility must increase with increasing concentration of the solution. It is necessary also to regard Arrhenius' formula  $\alpha = \mu/\mu_{\infty}$  as valid only in very dilute solutions.

J. C. P.

**Specific Volume as the Determining Criterion of Chemical Combination in Metal Alloys. II.** E. MAEY (*Zeit. physikal. Chem.*, 1904, 50, 200—218. Compare Abstr., 1901, ii, 655).—In the case of alloys where there is no chemical combination, the specific volume can be calculated by the mixture formula to within 1 per cent. of its true value. A greater deviation than this is due generally to the formation of a compound, or sometimes, if less marked, to that of solid solutions only. The specific gravity of a large number of alloys of different composition has been determined, and from the break in the curve obtained by plotting specific volume against composition it appears that in eight out of the thirteen binary alloys investigated chemical combination of the component metals takes place. The compounds thus indicated are  $\text{Sb}_3\text{Zn}_2$ ,  $\text{Sb}_2\text{Cd}_3$ ,  $\text{SbAg}_3$ ,  $\text{SbCu}_3$ ,  $\text{AgZn}_4$ ,  $\text{AgCd}_2$  or  $\text{AgCd}_3$ ,  $\text{CuCd}_2$ ,  $\text{AgHg}$ . The existence of several of these has been indicated by other methods (compare, for example, Hersch-kowitsch, Abstr., 1898, ii, 582; Heycock and Neville, Abstr., 1897, ii, 245), but the exact formula adopted differs in some cases. With the combinations  $\text{Zn—Hg}$ ,  $\text{Cd—Hg}$ ,  $\text{Cd—Zn}$ ,  $\text{Bi—Zn}$ , and  $\text{Pb—Zn}$ , there was no certain indication of the existence of a compound.

Stress is laid on the treatment of the specific volume, and not the specific gravity, as an additive property.

J. C. P.

**Vapour Pressure by Air-bubbling.** EDGAR P. PERMAN (*J. Physical Chem.*, 1905, 9, 36—39).—Doubts regarding the accuracy of the method of air-bubbling for the determination of vapour pressure have been raised by Carveth and Fowler (Abstr., 1904, ii, 541). The author defends the method and quotes results obtained previously by himself to show that with sufficient care accuracy is obtainable, at any rate, in the case of water as solvent. He further raises objections to the methods employed by Carveth and Fowler in their experiments (compare Trans., 1903, 83, 1168).

L. M. J.

**Dissociation of Nitro-derivatives in Certain Solvents. III.** GIUSEPPE BRUNI and B. SALA (*Gazzetta*, 1904, 34, ii, 479—485. Compare Bruni and Berti, Abstr., 1900, ii, 591 and 592).—Determinations of



the elevations of the boiling points of solutions of naphthalene, diphenyl, dibenzyl, and trichlorobenzene in acetonitrile give the mean value 17.3 for the molecular elevation of the boiling point of this solvent. The number given by Kahlenberg (*Abstr.*, 1902, ii, 310), namely, 14.39, is hence low.

In boiling acetonitrile, picric acid, picryl chloride [1:3:5-trinitro-2-chlorobenzene], 2:4:6-trinitrotoluene, trinitro-*p*-xylene, and dinitromesitylene all undergo a considerable amount of dissociation, whilst bromodinitromesitylene\* exhibits normal ebullioscopic relations. The behaviour of the last-named compound, in which the hydrogen atoms of the benzene nucleus are all substituted, is in accord with that of trinitromesitylene in formic acid solution (Bruni and Berti, *loc. cit.*).

In methyl-alcoholic solution, picryl chloride, trinitro-*p*-xylene, and dinitromesitylene all undergo dissociation. In boiling ethyl alcohol or acetone, however, picryl chloride gives perfectly normal molecular weights.

The theory put forward by V. Meyer (*Abstr.*, 1896, i, 419) to explain the dissociation of nitro-compounds supposes that, under the electro-negative action of the nitro-groups, one of the hydrogen atoms of the aromatic nucleus becomes capable of dissociation without the intermediate formation of *isonitro*-groups. To ascertain whether other electro-negative groups exert a similar influence to that of the nitro-group, the author has determined the molecular weight of *s*-trichlorobenzene in boiling acetonitrile and methyl alcohol. The numbers obtained are quite normal, showing that the power of exciting dissociation is a specific property of the nitro-group, and not a general one of all electro-negative groups.

T. H. P.

**Diffusion of Salts in Solution.** J. C. GRAHAM (*Zeit. physikal. Chem.*, 1904, 50, 257—272).—Vertical columns of salt solution and pure water of the same section are brought together, so that there is no initial mixing at the common surface. After some time, the salt concentration at various levels both above and below the common surface is determined. The author takes Fourier's series as the groundwork of his computations, and concludes from his experiments that the diffusion of salts follows the same laws as the conduction of heat. The diffusion constant for each salt is independent of the density of the solution and of the time during which diffusion has taken place. The salts employed in the author's experiments were the chlorides of sodium, potassium, ammonium, zinc, and manganese, the nitrates and carbonates of sodium and potassium, and ammonium sulphate. The results obtained indicate no evident connection between the value of the diffusion constant and the molecular weight. When sodium and potassium chlorides and sodium and potassium nitrates are allowed to diffuse in dilute hydrochloric acid and dilute nitric acid respectively instead of in pure water, slightly higher values are obtained for the diffusion constant.

J. C. P.

**Diffusion of Electrolytes in Water.** L. WILLIAM ÖRÖLM (*Zeit. physikal. Chem.*, 1904, 50, 309—349).—The electrolytes studied were

the chlorides of lithium, sodium, and potassium, the hydroxides of sodium and potassium, potassium iodide, and hydrochloric and acetic acids. In all cases there was found a certain concentration below which the diffusion-coefficient increases as the solutions become more dilute. From the same point, the coefficient increases also with increasing concentration, and consequently exhibits a minimum, provided that the formation of complex molecules at higher concentrations does not mask the true variation of the diffusion-coefficient. The concentration at which the minimum occurs is different for different electrolytes.

The temperature-coefficient of the diffusion constant varies also with the electrolyte studied, and is equal to the sum of the temperature-coefficients of the osmotic pressure and the electric conductivity. The author's experiments are in harmony with Nernst's theory dealing with the calculation of diffusion-coefficients at infinite dilution (*Zeit. physikal. Chem.*, 1888, 2, 613) and with Arrhenius' views on the variation of the diffusion-coefficient with the dilution (*Abstr.*, 1892, 1265).

It is shown that the internal friction of the molecule is somewhat less than the sum of the corresponding quantities for the ions.

J. C. P.

### Verification of a Recent Equation of Van der Waals.

JOHANNES J. VAN LAAR (*Arch. Néerland*, 1904, [ii], 9, 389—417. Compare Van der Waals, *Abstr.*, 1901, ii, 644).—1. *Variation of  $b$  in the Case of Hydrogen.*—Van der Waals has asserted (*loc. cit.*) that in the case of a diatomic gas the relationship  $(b + b_0)/(v - b) = 1 - [(b - b_0)/(b_1 - b_0)]^2$  holds where  $b_0$  is the least value of  $b$  (reached when the atoms are in contact) and  $b_1$  its greatest value (obtained when the volume of the gas is infinitely great). Comparing the values of  $b$  calculated from this relationship with those deduced directly from Amagat's results, it is found that the two values only become concordant for pressures above 300 atmospheres at 0°, above 400 atmospheres at 100°, and above 250 atmospheres at 200°. Further, the critical constants calculated on the assumption that the values of  $b_0$  and  $b_1$  are independent of the temperature, as is implied by Van der Waals's hypothesis that the value of  $a$  is directly proportional to the absolute temperature, are not in good agreement with those determined experimentally, in particular there is lack of concordance in the calculated and observed critical volumes.

From his results the author draws the conclusion that  $(b_0 - b_1)^2$  is proportional to the absolute temperature,  $b_1$  being constant and  $b_0$  variable, while  $a$  is independent of temperature.

II. *Specific Heats of Liquids at Low Temperatures.*—It is shown that specific heats at constant volume calculated from the relation  $C_v = RT[2/T - 1/(v - b)(db/dT)_v + 1/(b - b_0)(d\{b - b_0\}/dT)_v]$ , on the assumption that  $b_1 - b_0 = \sqrt{\gamma T}$  (see above), are in good agreement with those determined experimentally. The concordance of the calculated and observed results for liquids affords a further proof that the variation in value of  $(b_1 - b_0)$  with temperature is due to change in  $b_0$ ,  $b_1$  remaining constant.

It is pointed out that for many diatomic and for some more complex substances the quotient of melting point by critical temperature, both being expressed on the absolute scale, is approximately 0.5.

T. A. H.

**Validity of the Law of Corresponding States for Mixtures of Methyl Chloride and Carbon Dioxide.** H. KAMERLINGH ONNES and C. ZAKRZEWSKI (*Proc. K. Akad. Wetensch. Amsterdam*, 1904, 7, 285—290 and 377—382. Compare Abstr., 1904, ii, 807).—From a study of the conditions of coexistence, it appears that for mixtures of methyl chloride and carbon dioxide there are deviations from the law of corresponding states which become very marked for liquid densities and low temperatures.

J. C. P.

**More Exact Equation of Condition for Gases. III.** J. B. GOEBEL (*Zeit. physikal. Chem.*, 1904, 50, 238—240).—A supplementary note to earlier papers (see Abstr., 1904, ii, 311, 706).

J. C. P.

**Kinetics of the Nitration Reaction.** HAAVARD MARTINSEN (*Zeit. physikal. Chem.*, 1904, 50, 385—435).—The nitration of nitrobenzene to *m*-dinitrobenzene in concentrated sulphuric acid solution is shown by experiments at 0° and 25° to be a reaction of the second order, although the velocity-coefficient at 0° falls off slightly with the time, probably because part of the nitrobenzene undergoes sulphonation during the long time required for the experiments at the lower temperature. The velocity of nitration is more than trebled for a rise of 10°. The velocity varies also with the strength of the sulphuric acid used as medium, and reaches a maximum when the molecular ratio of sulphuric acid to water is about 1.0:0.7. The course of the change was followed by taking portions of the reaction mixture from time to time, and either extracting the nitro-compound with ether and determining the amount of stannous chloride oxidised by it, or estimating the amount of unconsumed nitric acid in a nitrometer.

The nitration of 2:4-dinitrotoluene or of *o*-, *m*-, and *p*-nitrobenzoic acids follows the course of a bimolecular reaction. The introduction of a methyl group in the nitrobenzene molecule increases the velocity of nitration. A carboxyl group has the opposite effect, but the extent of its influence depends on its position, and is lessened by converting the acid into ester. The introduction of a nitro-group diminishes the rate of nitration to a greater extent than the introduction of a carboxyl group. When *p*-nitroaniline is nitrated, two nitro-groups are introduced at nearly the same rate, and the reaction results in the formation of picramide. The rate of nitration of  $\alpha$ -nitronaphthalene is greater than that of nitrobenzene.

The nitration of phenol in aqueous solution is a complicated autocatalytic reaction, the velocity increasing with increasing acid concentration, but decreasing with increasing phenol concentration. The velocity of nitration is increased markedly by the addition of potassium nitrate or sulphuric acid, to a less extent by the addition of sodium and strontium nitrates. Nitrous acid acts as a catalytic agent, and the autocatalytic character of the reaction is to be attributed to the production of this substance during the nitration process; the rate of



nitration and the rate of production of nitrous acid run parallel, and when the production of nitrous acid is prevented no nitration takes place, at least when the nitric acid concentration is not too great. Nitrosophenol increases the velocity of nitration, but its effect is almost independent of its concentration.

The nitration of *p*-cresol is very similar to that of phenol.

J. C. P.

**Chemical Kinetics of the Benzoin Synthesis (Catalysis by Cyanide Ions).** ERNST STERN (*Zeit. physikal. Chem.*, 1905, 50, 513—559. Compare Lapworth, *Trans.*, 1903, 83, 995).—The gradual conversion of benzaldehyde into benzoin in aqueous alcoholic solution under the influence of potassium cyanide may be followed by taking samples of the reaction mixture from time to time and estimating their reducing power with Fehling's solution. The change, for the first half of its course at least, and within certain concentration limits, is regular, and follows the course of a bimolecular reaction. The rate of change is further proportional to the concentration of the potassium cyanide, and a similar statement applies when other ionised cyanides are used; when, however, the  $-\text{CN}$  group is in a complex, it is without influence. It thus appears that the reaction is one in which the catalytic agent is the cyanide ion. Free hydrocyanic acid and free alkali are without catalytic effect, although in certain circumstances they may give rise to secondary reactions. When the percentage of water in the aqueous alcohol is raised, the rate of change increases. The variation of the reaction velocity with temperature is in accordance with the usual law. The influence of benzaldehyde on the conductivity of an aqueous alcoholic solution of potassium cyanide is inappreciable at higher temperatures, but is considerable at  $0^\circ$ , and the experiments made in this connection indicate a reversible interaction between benzaldehyde and potassium cyanide. The various theories of the benzoin synthesis that have been advanced are discussed, and those which refer the synthesis solely or chiefly to the presence of alkali or hydrocyanic acid are regarded as discounted by the author's experiments.

J. C. P.

**Mechanism of Ether Formation from Alkyl Haloid (or Halogen Dinitrobenzene) and Sodium Alkyloxide.** C. A. LOBRY DE BRUYN and S. TIJMSMA (*Zeit. physikal. Chem.*, 1904, 50, 436—442. Compare Hecht, Conrad, and Brückner, *Abstr.*, 1889, 931; 1890, 4, 327, 1046; de Bruyn and Steger, *Abstr.*, 1899, i, 744, 745; Nef, *Abstr.*, 1900, i, 4; Luloffs, *Abstr.*, 1902, i, 87; Burke and Donnan, *Trans.*, 1904, 85, 555).—To explain the peculiarities in the rate of formation of ethers as observed and discussed by the above-mentioned investigators, the authors suppose that the alkyl haloid is dissociated to a slight extent. This would account for the influence of added sodium haloid in lessening the rate of change. The fact that a velocity constant is obtained at all, in spite of the sodium haloid produced during the change, might be attributed to the formation of a compound between the ether and the sodium haloid, but some experiments made by the authors are unfavourable to this explanation. The reaction

mixture becomes more dilute with respect to alkyl haloid as the change proceeds, and possibly the consequent increase of dissociation of the alkyl haloid is exactly neutralised by the effect of the sodium haloid produced.

J. C. P.

**Periodic Contact Catalysis. II.** GEORG BREDIG and E. WILKE (*Chem. Centr.*, 1905, i, 64; from *Verh. Heidelberg Natur-hist. med. Ver.*, 1904, [N.F.], 8, 165—181. Compare Bredig and Weinmayr, 1903, ii, 279).—In strongly alkaline solution, hydrogen peroxide is rapidly and continuously decomposed in contact with mercury which acts catalytically. In acid solution, the mercury is slowly oxidised, whilst in feebly alkaline solution the action is of periodic character and oxygen is intermittently evolved. The best results are obtained when the concentration of the alkali is  $10^{-3}$  to  $10^{-4}$  gram-mols. per litre. The rate of intermittence increases during an experiment; it diminishes with fall of temperature, whilst rise of temperature beyond a certain limit causes the action to become aperiodic. The periodicity is also affected by pressure and by light.

When the mercury surface is made an anode or a cathode in contact with alkaline hydrogen peroxide solution, the periodic phenomena are still observable. The quantity of alkali necessary for the effect varies with the potential of the mercury. The effect is diminished by extremely small quantities of alkali chloride ( $1/25000$ — $1/50000$  mols. per litre), probably in consequence of the formation of a thin layer of mercurous chloride. Nitrates are without action; sulphates diminish the pulsation when added in larger quantity.

The character of the pulsations has been studied in a similar manner to that adopted in Ostwald's experiments on the solution of chromium in acids. The regular curves obtained indicate a slow continuous change during the active period, and a rapid fall when the maximum has been reached. The form of these curves is altered when any foreign substance is added to the solution. The addition of colloids causes the apices of the curves to assume a much more pointed character. The action of the colloids probably consists in altering the rate of formation and the stability of the oxide layer on which the periodic phenomena depend.

H. M. D.

**Influence of Metals on the Hydrolysis of Sucrose.** RUDOLF VONDRÁČEK (*Zeit. physikal. Chem.*, 1905, 50, 560—566).—The influence of platinum in compact form on the rate of inversion of sucrose is very slight (see also Rayman and Sulc, *Abstr.*, 1897, ii, 136; Lindet, *Abstr.*, 1904, i, 293; Plzák and Hušek, *ibid.*, ii, 391). Fresh platinum black, however, has a marked accelerating effect, but the author has observed that a sample of platinum black once used to induce inversion is without effect on a second sucrose solution. Drying at  $150^{\circ}$  restores its activity (compare Purgotti and Zanichelli, *Abstr.*, 1904, ii, 329), which is therefore probably due to the presence of oxygen. When a sucrose solution is heated for a short time with platinum black and then filtered, the inversion proceeds according to the formula for a unimolecular reaction, the inverting agent being the oxidation products of the sugar. Indeed, evidence of the presence of

H<sup>+</sup> ions in a sucrose solution treated with platinum black can be deduced from measurements of the conductivity. J. C. P.

**Solubility of some Sparingly Soluble Salts in Water at 18°.** FRIEDRICH KOHLRAUSCH (*Zeit. physikal. Chem.*, 1904, 50, 355—356. Compare Abstr., 1903, ii, 528).—Values for the solubility deduced from the conductivity of the saturated solutions are here recorded for a number of sparingly soluble salts. The list has been prepared for the new edition of Landolt and Börnstein, and is almost complete, although some points still remain to be examined, such as the influence of temperature on the solubility. The temperature for which the present numbers are valid is 18°, except in the cases of silver bromide and iodide, where the temperature is 21°. In the following list, the first number after the name of the substance is the specific conductivity of the saturated solution, the second, in brackets, is the weight in milligrams of the substance per litre of the saturated solution: barium fluoride, 1530 (1630); strontium fluoride, 172 (117); calcium fluoride, 40 (16); magnesium fluoride, 224 (76); lead fluoride, 431 (640); silver chloride, 1.25 (1.6); silver bromide, 0.075 (0.107); silver iodide, 0.002 (0.0035); thallium chloride, 1514 (3040); thallium bromide, 192 (420); thallium iodide, 22.3 (56); mercurous chloride, 1.2 (2); mercuric iodide, 0.2 (0.4); silver iodate, 11.9 (40); lead iodate, 6.2 (19); barium sulphate, 2.4 (2.3); strontium sulphate, 127 (114); gypsum, 1885 (2040); lead sulphate, 32.4 (41); barium chromate, 3.2 (3.8); silver chromate, 18.5 (25); lead chromate, 0.1 (0.2); barium oxalate ( $\text{BaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ), 78.3 (86); strontium oxalate ( $\text{SrC}_2\text{O}_4$ ), 54 (46); calcium oxalate ( $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ ), 9.6 (5.6); magnesium oxalate ( $\text{MgC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ), 200 (300); zinc oxalate ( $\text{ZnC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ), 8 (6.4); cadmium oxalate ( $\text{CdC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ ), 27 (33); silver oxalate ( $\text{Ag}_2\text{C}_2\text{O}_4$ ), 25.5 (35); lead oxalate ( $\text{PbC}_2\text{O}_4$ ), 1.3 (1.5).

In some of the foregoing numbers, the last number is uncertain.

J. C. P.

**Molecular Attraction (3).** J. E. MILLS (*J. Physical Chem.*, 1904, 8, 593—636).—In the two previous papers (Abstr., 1902, ii, 596; 1904, ii, 642), the equation  $L - E = k(\sqrt[3]{d} - \sqrt[3]{D})$  was applied to 21 different substances employing values for  $L$  calculated from  $dp/dT$ , the latter ratio being obtained not from vapour pressure observations themselves, but from these results smoothed by Biot's formula. The constant  $b$  of the equation  $p = bT + a$ , proposed by Ramsay and Young, is a  $dP/dT$ , and at the critical temperature is identical with the  $dP/dt$  of the thermodynamical equation. It was found that by use of  $b$  instead of the Biot  $dP/dT$  better agreement was obtained at the critical temperature in those cases where the accord had previously been unsatisfactory. It was also found that in the cases where divergencies in the values of the constant occur, irregularities also occur in the curve representing  $PV$  against temperature. The author gives a number of curves for  $L - E$  against  $\sqrt[3]{d} - \sqrt[3]{D}$ , which indicate very clearly the agreements of the constants. Three equations are now



available for calculating latent heats. (1) The thermodynamical  $\tilde{L} = T/J \cdot (V - v) dP/dT$ ; (2)  $L = \mu'(\sqrt[3]{d} - \sqrt[3]{D}) + E$ , and (3) Crompton's equation,  $L = 2RT \log d/D$ . The values of  $L$  for the different substances examined are calculated from these equations; it is seen that as a rule Crompton's equation at low temperatures gives high results, but at high temperatures gives results in better accord with (2) than those calculated by equation (1). For high temperatures, therefore, Crompton's equation should prove of considerable value, as owing to the uncertainty in the values of  $dP/dT$  the values obtained thermodynamically are untrustworthy. Curves are given for the variation of internal latent heat with temperature; it is seen that all are concave towards the temperature axis, but no simple empirical formula could be obtained. From the equation previously given, the value of  $a$  in Ramsay and Young's expression may be calculated. In the case of isopentane, the value obtained is 159,400, the volume  $V$  being 4.266. Young obtained the value 157,880 at  $V = 4.3$  from the drawn isochors, and 162,890 by calculation. It is shown also that at the critical temperature the following relations hold: (1)  $P = dP/dT \cdot T - 10,471 \mu' / V^{4.3}$ ; (2)  $dP/dT = 124,860 / mV$ , and (3)  $m\mu' \sqrt[3]{d}/T = \text{constant}$ . L. M. J.

**Theory of Colloids.** EDUARD JORDIS (*Chem. Centr.*, 1904, ii, 1683—1686; from *Mon. Sci.*, [iv], 18, 797—818. Compare Abstr., 1904, ii, 714).—According to the theory propounded, colloidal solutions do not differ essentially from ordinary solutions. A comparison of the properties of colloids with those of crystalloids indicates that no sharp line of demarcation can be drawn between the two classes. As yet a pure hydrosol has not been prepared, and it is probable that purification leads in all cases to the formation of a hydrogel. The hydrosols, therefore, are not pure substances, but are to be regarded as combinations which the author designates as "chemical colloids."

The process of neutralisation of acid and basic colloids, the precipitation of albumin by alkali halogen salts in acid and alkaline solution, the influence of concentration on the precipitation of colloids, the causes of hydrogel formation, the electrolysis of hydrosols, the different hypotheses relative to the structure of hydrogels, and many other points are discussed, for which the original must be consulted.

Incidentally the author divides the colloids into six groups according to their modes of formation. These are (1) precipitation by alkali, by hydrolysis, or by acids; (2) precipitation by hydrogen sulphide; (3) formation of halogen colloids from metallic hydrosols; (4) formation of complex substances such as Prussian blue; (5) reduction of salts of heavy metals; (6) electrical disintegration of metals under water.

H. M. D.

**Solid Solutions and Isomorphism.** GIUSEPPE BRUNI and A. TROVANELLI (*Gazzetta*, 1904, 34, ii, 349—357).—Thioacetic acid gives abnormally small freezing point depressions in acetic acid solution. Thioacetamide, on the other hand, gives depressions greater than the normal values in solution in acetamide (the constant of which was determined to be 36.3). In formamide (the freezing point constant of

which was found to be 38.5), thioacetamide gives normal depressions, showing that here the thioacetamide is not appreciably dissociated and that mixed crystals are not formed with acetamide. In urethane solutions, ethyl thiocarbamate gives depressions smaller than the normal values, whilst xanthamide or ethyl sulphocarbamate gives depressions slightly greater than the normal ones. Compounds of the aliphatic series containing the group  $\text{:C}\cdot\text{SH}$  hence form solid solutions with the corresponding compounds containing the complex  $\text{:C}\cdot\text{OH}$ , but those with the grouping  $\text{:C}\cdot\text{S}$  are not able to crystallise with the corresponding oxygen compounds.

Thiophenol exhibits normal cryoscopic behaviour in phenol solutions.

*p*-Fluoronitrobenzene gives depressions somewhat higher than the normal values when dissolved in *p*-chloronitrobenzene, the molecular freezing point depression for which is 108. This is the first observed case of isomorphism between fluoro- and chloro-organic derivatives.

T. H. P.

**Decomposition of Hydrated Mixed Crystals. II.** REINHARD HOLLMANN (*Zeit. physikal. Chem.*, 1905, 50, 567—594. Compare Abstr., 1902, ii, 446).—A theoretical paper.

J. C. P.

**Mixed Crystals in Systems of Three Substances.** FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1904, 50, 169—199).—A theoretical paper.

J. C. P.

**Method for the Determination of the Affinities of Acids Colorimetrically by means of Certain Vegetable Colouring Matters.** JOSEPH H. KASTLE (*Amer. Chem. J.*, 1905, 33, 46—59).—It is shown that dilute solutions of certain vegetable colouring matters can be used for determining the relative strengths of acids. The following materials have been found to contain colouring matters capable of employment for this purpose: the skin of the purple grape and of the wild grape (*Vitis vulpina*), the flowers of the red geranium, purple petunia, the scarlet sage (*Salvia fulgens*), and the red rose. The reagent is prepared by macerating the grape skins (or other material) with water, boiling, filtering, adding a small quantity of solution of egg albumin to clear the liquid, which is afterwards boiled and filtered. A current of sulphur dioxide is then passed into the liquid until the colour is almost discharged, and the excess of sulphur dioxide is removed by boiling, a little toluene being added as a preservative. The effect of various acids on the reagent has been studied, and it is found that the colouring matter is regenerated on the addition of an acid, the intensity of the colour varying according to the affinity of the acid.

On arranging the acids in order of their affinity as determined by this process, it is found that this order agrees closely with that obtained by Ostwald's methods.

It has not been found possible to exhibit the difference in strength between the very weak acids, such as acetic, propionic, and butyric acids, by this colorimetric method, but it is thought that possibly this may be effected by varying the concentration.

E. G.

**Sixth Report of the Committee [of the German Chemical Society] for Fixing Atomic Weights.** HANS LANDOLT, WILHELM OSTWALD, and OTTO WALLACH (*Ber.*, 1905, **38**, 13—22. Compare Abstr., 1902, ii, 129; 1903, ii, 68; 1904, ii, 20).—This report deals with the replies to a circular addressed to the members of the International Committee relating to the basis of the atomic weights. Of the fifty-nine members, thirty-nine recorded their votes, and of these thirty-two were in favour of the exclusive publication of the table based on  $O=16$ , two were in favour of the table in which  $H=1$ , whilst five were in favour of both tables being given. The committee therefore proposes the exclusive use of the values based on  $O=16$ .

C. H. D.

**Theory of Valency.** RICHARD ABEGG (*Zeit. anorg. Chem.*, 1905, **43**, 116—121. Compare Abstr., 1903, ii, 536; 1904, ii, 475).—A theoretical paper in which the following problem is discussed. If an uncombined polyvalent atom of an element is present in a system containing an amount of another element insufficient to form the compound corresponding with the lowest stage of combination, will one valency of the atom in question be concerned in the formation of the compound, or will all the valencies take a part? Although experience appears to favour the first alternative, the latter is considered to be the more correct, especially since the affinities of the different valencies of one atom have not all the same value.

A. McK.

**Conception of Valency.** RICHARD ABEGG and F. WILLY HINRICHSSEN (*Zeit. anorg. Chem.*, 1905, **43**, 122—124).—A criticism of the views of Billitzer (Abstr., 1904, ii, 720), who considers that the valency of an element is a function of the temperature. The authors draw a sharp distinction between the valency of an element and its "affinity."

A. McK.

**Hydration and Hardening.** EDUARD JORDIS (*Zeit. Elektrochem.*, 1904, **10**, 938—940).—The views regarding the hardening of Portland cement and gypsum expressed by Rohland (this vol., ii, 19) are adversely criticised. The acceleration of the setting of cement by the addition of salts is not a catalytic process, since the salts added react with the cement and undergo permanent change.

T. E.

**Siphon with a Mercury Valve.** FERDINAND PILZ (*Chem. Centr.*, 1905, i, 133; from *Zeit. Landw. Vers.-Wes. Oesterr.*, **7**, 819).—The delivery tube is bent in a U-form, and is connected by a tube from the bottom of the bend with a pear-shaped glass bulb, which is attached by a ground glass joint and is capable of rotation. The bulb and U-tube contain mercury, and by rotating the bulb downwards the level of mercury is depressed, so that the liquid may pass the bend of the delivery tube.

The valve is designed for use with alkaline liquids, for which glass or rubber is undesirable.

G. D. L.



## Inorganic Chemistry.

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**Hypochlorous Acid. III. Formation and Decomposition of Chloric Acid.** JULIUS SAND (*Zeit. physikal. Chem.*, 1904, 50, 465—480. Compare Abstr., 1904, ii, 612).—The slow liberation of chlorine at 70° in a solution containing potassium chlorate and hydrochloric acid has been quantitatively followed. It appears that the reaction is quinquemolecular, and that the rate of change at any moment is given by the equation  $dx/dt = k[\text{ClO}_3'] \cdot [\text{H}']^2 [\text{Cl}']^2$ . The velocity actually measured is probably that of the action  $\text{ClO}_3' + 2\text{H}' + 2\text{Cl}' = \text{ClO}' + 2\text{HOCl}$ , the hypochlorous acid then reacting instantaneously with hydrochloric acid to produce chlorine. The absolute value of  $k_{70}$  works out to  $0.56 \times 10^{-3}$ .

The action represented by the foregoing equation is reversible, as shown by Foerster, who has also determined the velocity of the change  $\text{ClO}' + 2\text{HOCl} = \text{ClO}_3' + 2\text{H}' + 2\text{Cl}'$  (see Abstr., 1901, ii, 309). The author also has determined the velocity  $k'$  of this change and finds  $k'_{70} = 53.1$ . From the values of  $k$  and  $k'$  it is possible to deduce the equilibrium constant  $K$  of the reversible reaction,  $\text{ClO}_3' + 6\text{H}' + 5\text{Cl}' \rightleftharpoons 3\text{H}_2\text{O} + 3\text{Cl}_2$ ; the value thus obtained is  $K_{70} = 0.995 \times 10^{-11}$ . From the known heat effect of the reaction, the author then calculates  $K_{20} = 0.54 \times 10^{-11}$ . Further, it can be shown that an electrode immersed in a solution containing the ions  $\text{H}'$ ,  $\text{Cl}'$ , and  $\text{ClO}_3'$  in equilibrium would assume the potential 1.434 volts against the normal hydrogen electrode (compare Luther, Abstr., 1902, ii, 641). J. C. P.

**Atomic Weight of Iodine.** PAUL KÖTHNER and E. AEUER (*Annalen*, 1904, 337, 362—369. Compare Abstr., 1903, ii, 360—566, and this vol., ii, 81).—Baxter's recent determination of the atomic weight of iodine (this vol., ii, 81) is discussed. It is pointed out that Stas' erroneous result cannot be attributed to an admixture of silver nitrate in the silver iodide, since the same result was obtained with the sulphate. The suggestion that the iodine is possibly admixed with a small quantity of a new element is very doubtful. If the atomic weight of iodine is calculated from Ladenburg's results, using the new value found by Richards and Wells for chlorine, the number 126.985—126.991 ( $\text{O} = 16$ ) is obtained. Baxter's calculation,  $\text{I} = 126.964$ , is incorrect. The most probable value for the atomic weight of iodine deduced from these two researches is 126.98. The mean of the 41 determinations made by Scott, Ladenburg, Baxter, and the authors is 126.97 ( $\text{O} = 16$ ). K. J. P. O.

**Polysulphides. I.** FRIEDRICH W. KÜSTER and EDUARD HEBERLEIN (*Zeit. anorg. Chem.*, 1905, 43, 53—84).—The solubility of sulphur in a solution of sodium sulphide is almost independent of the temperature between the limits of 0° and 50°, its solubility diminishing very slightly with increase of temperature. The solubility of sulphur in a solution of sodium sulphide depends greatly on the dilution of the

latter. It is greatest in a  $N/16$  solution, where the constitution of the solution approximates to the formula  $\text{Na}_2\text{S}_{5.24}$ . There is evidence that in the solutions examined no uniform compounds are present, but that various substances are in a condition of complex equilibrium with one another. All sulphides and polysulphides undergo much hydrolysis in aqueous solution. The extent of hydrolysis diminishes regularly with increasing amount of sulphur in the solutions.

The representation of polysulphides as thio-salts of thio-oxy-acids is untenable, as also is Geuther's representation of them as sulphides of polyvalent metals. The formulæ advanced by Spring are also inadequate.

Polysulphides are salts of complex thio-acids of the type  $\text{H}_2\text{S}_x\text{S}_x$ , which are analogous to the complex iodides,  $\text{HI}_2\text{I}_2$  and  $\text{HI}_4\text{I}_4$ .

A. McK.

**Theory of the Lead Chamber Process.** GEORG LUNGE (*Zeit. angew. Chem.*, 1905, 18, 60—71).—Polemical. A reply to Raschig (this vol., ii, 23).

A. McK.

**Density and Expansion of Sulphuric Acid in Aqueous Solution.** J. DOMKE and W. BEIN (*Zeit. anorg. Chem.*, 1905, 43, 125—181).—The authors have investigated the relationships between concentration, density, and expansion of aqueous solutions of sulphuric acid and also the physico-chemical nature of sulphuric acid in various concentrations.

The maximum density, 1.8415 at  $15^\circ/4^\circ$ , was attained with a 97.25 per cent. of acid.

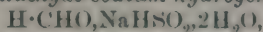
The formation of hydrates in sulphuric acid solutions is discussed. The existence of hydrates in solution cannot be deduced from density determinations alone. Examination of freezing point curves does not prove the existence of hydrates containing 1, 2, 4, and  $6\text{H}_2\text{O}$  respectively.

Hydrates containing 1 and  $2\text{H}_2\text{O}$  respectively certainly exist (Lespieau, Jones).

Sulphuric acid (99.52 per cent.) has a sp. gr. 1.8377 at  $15^\circ/4^\circ$ . The density determinations of the authors are contrasted with those of others, and extracts are given from the complete tables of the sp. gr. of aqueous solutions of sulphuric acid at various temperatures. The paper includes a very complete bibliography.

A. McK.

**Constitution of Hyposulphites.** MAURICE PRUD'HOMME (*Bull. Soc. chim.*, 1905, [iii], 33, 129—131).—Baumann, Thesmar, and Frossard prepare formaldehyde sodium hydrogen hyposulphite,



by the reduction of sodium hydrogen sulphite with zinc and sulphuric acid and precipitation with sodium chloride after removal of the zinc. The precipitate is dissolved in a 40 per cent. solution of formaldehyde, when a mixture of the desired product with formaldehyde sodium hydrogen sulphite crystallises out. From this, the hyposulphite additive product may be obtained in large, monoclinic crystals by

recrystallisation from dilute alcohol. It is, like all the additive products of formaldehyde with the hyposulphites, quite stable and is only resolved into its generators by steam at  $100^{\circ}$ , and under these conditions forms a powerful reducing agent (*Rev. Gen. Mat. Col.*, 1904, 353).

The formulæ ascribed to these compounds support Schützenberger's view (*Compt. rend.*, 1869, 69, 196) that the composition of sodium hyposulphite is represented by the formula  $\text{NaHSO}_2$  (compare Bernthsen and Bazlen, *Abstr.*, 1900, ii, 203). It is suggested that the salt  $\text{K}_2\text{S}_2\text{O}_4$ , obtained by Moissan by the action of sulphur dioxide on potassium hydride (*Abstr.*, 1903, ii, 75), is derived from a new sulphur acid and that it is hydrolysed by water according to the equation  $\text{K}_2\text{S}_2\text{O}_4 + \text{H}_2\text{O} = \text{KHSO}_2 + \text{KHSO}_3$ . In support of this view, it is stated that the product recrystallised from water contains both needles and stellate groups of acicular crystals.

T. A. H.

**Colloidal Selenium.** CARL PAAL and CARL KOCH (*Ber.*, 1905, 38, 526—534. Compare Schultze, *Abstr.*, 1886, 302; Gutbier, *Abstr.*, 1902, ii, 652).—The liquid hydrosol of selenium is obtained by reducing selenious acid, dissolved in aqueous sodium protalbate or lysalbate, with hydrazine hydrate and hydrochloric acid, or with hydroxylamine hydrochloride, and dissolving the precipitate so obtained in aqueous sodium carbonate. The liquid hydrosol, after purification by dialysis, is blood-red by reflected light, or, when strongly diluted, red by transmitted light. The solid hydrosol, obtained in dark red, glistening flakes when the solution is evaporated by gentle heat and finally over sulphuric acid, contains 32—50 per cent. of selenium, and is easily soluble in cold water. This form is much more stable than the hydrosols previously obtained; in aqueous solution, it remains unchanged on repeated alternate treatment with acetic acid and sodium hydroxide, or when boiled with an excess of 10 per cent. sodium chloride or phosphate solutions, but is gelatinised on addition of an excess of calcium chloride solution in the cold. A specimen of this solid hydrosol, after preservation for  $2\frac{1}{2}$  years, dissolved almost completely in water.

Colloidal selenium, containing up to 90 per cent. of selenium, is obtained by dissolving the solid hydrosol in water and adding acetic acid as long as precipitation takes place.

G. Y.

**The Brown and Blue Modifications of Colloidal Tellurium.** CARL PAAL and CARL KOCH (*Ber.*, 1905, 38, 534—546. Compare Gutbier, *Abstr.*, 1902, ii, 653; 1904, ii, 613).—The brown modification of colloidal tellurium is easily obtained by warming an alkaline aqueous solution of telluric acid, containing protalbic or lysalbic acid, with hydrazine hydrate on the water-bath; in neutral or alkaline solution, containing sodium protalbate or lysalbate, telluric acid is reduced by hydroxylamine only on boiling, as is tellurium dioxide by hydrazine hydrate; in these cases, the brown modification, at first formed, changes into the blue as the boiling proceeds. Gutbier and Resenschek's brownish-violet tellurium hydrosol is probably a mixture of the brown and blue modifications. As in the case of colloidal selenium, the liquid hydrosols of tellurium, containing sodium



protalbate or lysalbate, are very stable, and, on careful evaporation, yield the solid hydrosols, which are soluble in water and remain unchanged when heated to  $100^{\circ}$  in a vacuum. On addition of acetic acid to the liquid hydrosols, the solid hydrosols containing protalbic or lysalbic acid are precipitated; these contain upwards of 80 per cent. of tellurium, and are very stable when protected from the atmospheric oxygen, the brown modification retaining its solubility after three years.

G. Y.

**Radiotellurium.** IV. WILLY MARCKWALD (*Ber.*, 1905, 38, 591—594. Compare *Abstr.*, 1902, ii, 508; 1903, ii, 81, 733).—A quantity of crude tellurium, obtained from 15 tons of pitchblende, was treated as previously described. The product thus obtained was purified as follows. It was dissolved in dilute nitric acid and the filtered solution repeatedly evaporated with hydrochloric acid in order that the nitric acid should be expelled. A current of sulphur dioxide was then passed into the solution of the residue in dilute hydrochloric acid. The resulting precipitate consisted of a mixture of selenium, tellurium, and radiotellurium. It follows from this result that radiotellurium chloride is reducible by sulphurous acid. Radiotellurium is precipitated by sulphurous acid relatively with greater difficulty than the other substances. The precipitate (16 grams), obtained by means of sulphurous acid, was dissolved in dilute nitric acid, the solution evaporated to dryness, and the residue warmed with ammonia, a method of separation of radiotellurium from selenium and tellurium which was based on the supposition that radiotellurium oxide is not an acid anhydride, and is quite insoluble in ammonia. Three milligrams of a very radioactive product were thus obtained.

Measurements showed that the radioactivity of this product diminished with time. The rate of decay accords with the formula for unimolecular reactions, as is the case with all uniform radioactive substances. After 139.8 days, the intensity of the radioactivity sunk to one-half of the original.

Radiotellurium is a uniform radioactive substance, and is not identical with polonium, which, without doubt, is a mixture of radioactive substances. The rate of decay of Madame Curie's polonium, as measured by her, does not accord with the formula for unimolecular reactions.

Rutherford's Radium E is also not identical with radiotellurium.

A. McK.

**Formation of Ammonia from its Elements.** FRITZ HABER and G. VAN OORDT (*Zeit. anorg. Chem.*, 1905, 43, 111—115).—The authors have studied the equilibrium between nitrogen, hydrogen, and ammonia. A current of ammonia was passed over finely-divided iron at a high temperature, and the resulting gas, after having been freed from ammonia, passed over a fresh quantity of iron, which was maintained at the same temperature as in the initial case. A fresh amount of ammonia was produced by the latter treatment; this was again separated from the mixture, which was now found to be a mixture of nitrogen (1 vol.) and hydrogen (3 vols.).

The experiments were conducted with dry gases at pressures approximating to atmospheric. The temperature was about  $1000^{\circ}$ . Nickel is not so active a catalyst as iron. A. McK.

**Action of Hydrogen Fluoride on Nitrogen Sulphide, and a New Method of Formation of Thionyl Fluoride.** OTTO RUFF and CURT THIEL (*Ber.*, 1905, 38, 549—553. Compare Abstr., 1904, i, 396).—When heated at  $120^{\circ}$  in a closed platinum vessel, hydrogen fluoride and nitrogen sulphide unite to form a red liquid, which easily decomposes again into its components; in presence of traces of moisture, thionyl fluoride is formed. This may be prepared almost quantitatively by heating nitrogen sulphide, hydrogen fluoride, and copper oxide together at  $100^{\circ}$  in a copper bomb.

In presence of carbon or of sunlight, a mixture of chlorine and thionyl fluoride in a sealed glass tube react with the silica of the latter to form silicon tetrafluoride and sulphuryl fluoride. Thionyl fluoride and nitrogen trioxide, in presence of traces of moisture, react with silica to form nitrosulphonic acid and silicon tetrafluoride.

Thionyl chloride is not changed when repeatedly passed through a white hot platinum tube filled with platinum sponge. G. Y.

**New Experiments on the Preparation of Diamonds.** HENRI MOISSAN (*Compt. rend.*, 1905, 140, 277—283. Compare Abstr., 1897, ii, 549).—The appearance of the cross-section of the block of meteoritic iron from Cañon Diablo (this vol., ii, 43) seemed to indicate that the separation and crystallisation of the carbon had been influenced by the sulphur, silicon, and phosphorus present in the meteorite. The author's previous experiments have therefore been repeated with a view of testing whether the presence of these metalloids affects the crystallisation of the carbon under laboratory conditions. One hundred and fifty grams of Swedish iron were melted in a crucible in the electric furnace with excess of sugar charcoal, and at the end of two or three minutes, when the molten iron had become saturated with carbon the crucible was withdrawn, five grams of ferrous sulphide were added, and the whole was then rapidly cooled by immersing the crucible in cold water. Carbon separated in crystalline form from the central portions of the molten mass, and the yield was increased as a consequence of the presence of sulphur. No diamonds were obtained on the addition of sulphide if the mass was not rapidly cooled. The presence of silicon also appears favourable to the crystallisation of the carbon, whereas experiments in which phosphide of iron was added gave no result.

The synthetical diamonds are always feebly doubly refracting, but the amount is variable and bears no relation to the external form. This observation is in agreement with the optical behaviour of most natural diamonds. H. M. D.

**Combustible Gaseous Carbon Compounds in the Air.** HEINRICH WOLPERT (*Arch. Hygiene*, 1905, 52, 151—178).—In the free outer air, there exist certain incompletely oxidised carbon compounds. The amount of these materials in the Berlin atmosphere averages at

least 0.015 volume per 1000, that is, about 4.5 per cent. of the amount of carbon dioxide. The air of rooms contains at least as much, but if this is rendered still more impure by the burning of oils or gas or by respiration, these gaseous compounds of carbon increase.

W. D. H.

**The Action of Silicochloroform on some Fluorides and the Preparation and Properties of Silicofluoroform.** OTTO RUFF and CURT ALBERT (*Ber.*, 1905, **38**, 53—64. Compare Ruff and Plato, *Abstr.*, 1904, ii, 265).—Silicochloroform does not react with silver fluoride or lead fluoride even on prolonged heating.

Antimony trifluoride and silicochloroform react in a sealed tube according to the equation  $3\text{SiHCl}_3 + 4\text{SbF}_3 = 3\text{SiF}_4 + 2\text{Sb} + 2\text{SbCl}_3 + 3\text{HCl}$ . The same reaction occurs very vigorously in the case of arsenic trifluoride. Tin and titanium tetrafluorides, however, react in a different manner, for instance,  $3\text{SnF}_4 + 4\text{SiHCl}_3 = 4\text{SiHF}_3 + 3\text{SnCl}_4$ .

To prepare silicofluoroform, molecular quantities of silicochloroform and titanium tetrafluoride are heated together in a closed copper vessel or glass tube for 18 hours at 100—120°. The vessel is then cooled in liquid air and allowed to become warm slowly, the gases evolved being condensed by means of liquid air.

Silicofluoroform,  $\text{SiHF}_3$ , boils at  $-80.2^\circ$  under 758.5 mm. pressure (corr.) and melts at about  $-110^\circ$ . It slowly decomposes in a sealed glass tube, even at the ordinary temperature, according to the equation  $4\text{SiHF}_3 = 2\text{H}_2 + 3\text{SiF}_4 + \text{Si}$ , the decomposition being greatly accelerated by heat. It burns in air with a very pale blue flame, the temperature of ignition being higher than that of silicochloroform:  $12\text{SiHF}_3 + 6\text{O}_2 = 3\text{SiF}_4 + 3\text{SiO}_2 + 4\text{H}_2\text{SiF}_6 + 2\text{H}_2\text{SiO}_3$ .

Water and sodium hydroxide decompose it thus:  $2\text{SiHF}_3 + 4\text{H}_2\text{O} = \text{Si}(\text{OH})_4 + \text{H}_2\text{SiF}_6 + 2\text{H}_2$ . Alcohol forms ethyl orthosilicate,  $\text{Si}(\text{OEt})_4$ ; ether forms ethyl silico-orthoformate,  $\text{SiH}(\text{OEt})_3$ , and ethyl fluoride. Toluene dissolves its own volume of silicofluoroform.

The properties of the silicohalogenoform series are tabulated and compared.

C. H. D.

**Silicates.** V. EDUARD JORDIS and E. H. KANTER (*Zeit. anorg. Chem.*, 1905, **43**, 48—52. Compare this vol., ii, 88).—The influence of the length of time during which boiling is continued in the action of calcium hydroxide solution, either alone or in presence of calcium ions, on silicic acid has been examined. The analyses quoted show that at first calcium from the hydroxide quickly combines with the silica, afterwards it is partly removed from the compound formed, and then again combined with it to a greater extent than before. The anion is in some way or other transformed.

A. McK.

**Potassium and Ammonium Nitrates and the Law of Bravais.** FRÉDÉRIC WALLERANT (*Compt. rend.*, 1905, **140**, 264—266).—Potassium nitrate, like ammonium nitrate, exhibits polymorphism (*Abstr.*, 1904, ii, 31), the normal orthorhombic form at 129° passing into an  $\alpha$ -rhombohedral form, which on superfusion is converted into a  $\beta$ -rhombohedral variety.

M. A. W.



**Some Physical Characters of the Sodium Borates, with a New and Rapid Method for the Determination of Melting Points.** CHARLES H. BURGESS and ALFRED HOLT, jun. (*Proc. Roy. Soc.*, 1904, 74, 285—295. Compare *Proc.*, 1903, 221).—When pure borax glass is kept for some hours at such a temperature that it has the consistency of a viscid syrup, it gradually changes to a mass of colourless crystals. The latter are about as soluble in water as borax glass, are not hygroscopic, and melt at a higher temperature than the glass, into which they are reconverted on melting and then cooling quickly. The phenomenon of crystallisation on reheating, moreover, is exhibited by all mixtures of boric anhydride and sodium carbonate in which the ratio  $B_2O_3 : Na_2CO_3$  lies between 6:1 and 8:5. With the idea that the change was probably due to the crystallisation of some borate rich in sodium, the authors fused boric anhydride with a large excess of sodium carbonate, and found that the greatest proportion in which boric anhydride combined with sodium oxide is given approximately by  $B_2O_3 : Na_2O :: 1 : 1.3$ . The product obtained is therefore neither  $NaBO_2$  nor  $Na_3BO_3$ . The melting points of glasses and crystals of varying composition were determined with the view of discovering what compounds, if any, existed. A glass bead was used to attach a vertical weighted wire to a horizontal platinum wire suitably heated by a current. When the horizontal wire was raised to a sufficiently high temperature (which could be deduced from its resistance), the vertical wire dropped, and in this way the melting point of the glass was determined. The melting points of the glasses were well defined, but the melting point curve is irregular and difficult of interpretation. The melting point curve for the crystals exhibits a maximum about the composition  $5Na_2O, 4B_2O_3$ , which agrees with the ratio referred to above. It would appear that borax ( $Na_2O, 2B_2O_3$ ) is not a definite compound under these conditions, but approximately a eutectic mixture of the compounds  $5Na_2O, 4B_2O_3$  and  $Na_2O, 4B_2O_3$ , for the latter of which there is other evidence.

Experiments were also made in which, after powdering roughly, the crystals were picked out from the accompanying glass and analysed. With mixtures between  $Na_2O, 4B_2O_3$  and  $Na_2O, 2B_2O_3$ , the crystals and the glass have the same composition, and it is probable that in this case formation of mixed crystals or a solid solution from a superfused liquid has taken place. With mixtures containing more boric anhydride than  $Na_2O, 4B_2O_3$ , only a part crystallises, and the crystals have approximately the composition  $Na_2O, 6B_2O_3$ . If the crystals could be freed from glass, the composition would probably be  $Na_2O, 4B_2O_3$ .

The glass must be regarded as a superfused and, therefore, metastable form of the crystals, behaving in several respects as if it were a liquid of enormous viscosity.

J. C. P.

**Pentasulphides of Rubidium and Cæsium.** WILHELM BILTZ and ERNST WILKE-DÖRFURT (*Ber.*, 1905, 38, 123—130).—Rubidium and cæsium pentasulphides are formed by warming the monosulphides with powdered sulphur and aqueous alkali hydroxide solution in an atmosphere of hydrogen.

*Rubidium pentasulphide*,  $\text{Rb}_5\text{S}_5$ , crystallises in dark red, rhombic prisms, commences to blacken at  $170-185^\circ$ , melts at  $223-224^\circ$ , and has a sp. gr. 2.618 at  $15^\circ$ . When exposed to the air, it deliquesces to a red liquid from which sulphur crystallises out; it remains unchanged under cold alcohol, hot ethyl sulphide, or chloroform, but is decomposed by hot nitrobenzene, or more energetically by a mixture of nitrobenzene with ethyl or amyl alcohols; in contact with carbon disulphide, the red crystals slowly become yellow, the change being accompanied by absorption of carbon disulphide.

*Cæsium pentasulphide*,  $\text{Cs}_5\text{S}_5 \cdot \text{H}_2\text{O}$ , forms red crystals, melts at  $202^\circ$ , is not hygroscopic, and can be recrystallised without change from 70 per cent. alcohol. G. Y.

### Some Physical Constants of Calcium and Calcium Amalgam.

HENRI MOISSAN and CHAVANNE (*Compt. rend.*, 1905, 140, 122—127. Compare Abstr., 1900, ii, 76).—The authors have redetermined some physical constants of calcium, using for the purpose the metal prepared by the Bitterfeld electrolytic process, containing from 99.3 to 99.6 per cent. of calcium, the impurities consisting of calcium chloride, silicon, aluminium, and traces of sodium and iron, and dissolving slowly in pure water, but rapidly in water containing a trace of iron, gold, or platinic chloride. The electrical conductivity of calcium, measured in wires of 0.51 and 0.77 mm. diameter, is  $15.6$  at  $20^\circ$ , that of silver being taken as  $100^\circ$ . Calcium becomes pasty at  $790-795^\circ$  and melts at  $810^\circ$  (compare Arndt, this vol., ii, 87), and has a sp. gr. 1.548. Calcium dissolves slowly in mercury to form a solid crystalline mass, from which prismatic crystals of definite composition,  $\text{Hg}_8\text{Ca}$ , are isolated by fractional crystallisation in a vacuum; this amalgam is stable in dry air at the ordinary temperature, and dissolves slowly in water, thus forming a convenient reducing agent capable of reducing alkali nitrates to ammonia and traces of nitrites, ammonium sulphate to ammonium amalgam, and acetone to a mixture of pinacone and isopropyl alcohol. M. A. W.

**Red Coloration of Bleaching Powder.** NAZARENO TARUGI (*Gazzetta*, 1904, 34, ii, 466—468).—It is generally stated that the red coloration sometimes produced in bleaching powder by subjecting it to the action either of carbon dioxide or of gentle heat depends on the presence of small quantities of manganese which become transformed by the oxidising action of the bleaching powder into a calcium salt of permanganic acid. The author shows, however, that this is not the case, the red colour being due to the presence of a salt of ferric acid. T. H. P.

**Alkaline Reaction of Strontium and Calcium Carbonates.** L. BLUM (*Zeit. anal. Chem.*, 1905, 44, 12—13).—The carbonates of strontium and calcium wetted with water on red litmus paper change the colour to blue. Marble behaves in the same way. M. J. S.

**Action of Barium Amalgam on Solutions of Sodium and Potassium Salts.** GEORGE MCP. SMITH (*J. Physical Chem.*, 1905, 9, 13—35).—A controversial paper in which the author replies to Fernekcs (this vol., ii, 33). The author's experiments show that barium in barium amalgam may be replaced by potassium or sodium by the action of solutions of the hydroxides of these metals on the amalgam. The question of such replacement is briefly discussed at the end of the paper, and it is pointed out in the case of the action of barium amalgam on solutions of potassium salts that the separation of potassium or of hydrogen depends on the relative values of the ratios  $\sqrt[2]{P_{Ba}/p_{Ba}}$ ,  $P_K/p_K$  and  $P_H/p_H$ , where  $P$  and  $p$  are the electrolytic solution pressure and the osmotic pressure of the indicated elements. L. M. J.

**Metals found in the Archeological Excavations in Egypt.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 140, 183—185).—Two metallic specimens obtained from Egyptian tombs consist essentially of an alloy of tin and copper. The first specimen, dating from the end of the IIInd or the beginning of the IIIrd dynasty, was much corroded, and largely converted into copper oxychloride and carbonate and contained 56.7 per cent. of copper, 2 per cent. of tin, and traces of zinc. The second specimen, also from the tombs of the Pharaohs, was well preserved and contained 87.44 to 87.52 per cent. of copper, 11.47 per cent. of tin, and traces of lead. Neither specimen contained arsenic, silver, or iron. M. A. W.

**Reduction of Metallic Oxides by means of the Cerite Metals.** L. WEISS and O. AICHEL (*Annalen*, 1904, 337, 370—389).—The alloy of the cerite and yttrium metals, the "Mischmetall," obtained from the oxides in the residue of the manufacture of thorium nitrate, has all the requirements of a good reducing agent, as it has a high heat of combustion and forms easily fusible and stable oxides. It cannot be obtained as a powder but in filings, which, however, cannot be kept. In compact pieces, it can be kept unoxidised for months. Iron, nickel, cobalt, manganese, and chromium can easily be obtained pure by its means. Molybdenum was prepared in a pure state from molybdic acid, and forms a silver-white metal with crystalline fracture; it is not magnetic. Tungsten and uranium could not be prepared pure. Vanadium, niobium, and tantalum were easily prepared from the pentoxides. Vanadium forms a silver-white regulus, the surface of which showed crystalline structure; its hardness is 7, and it is brittle, but not magnetic, insoluble in potassium hydroxide, bromine water, hydrochloric acid, or dilute sulphuric acid, but soluble in concentrated sulphuric acid, hydrofluoric or nitric acid. It is oxidised to vanadates by molten alkali hydroxides, carbonates, or saltpetre, and when heated in the air is converted into the pentoxide. Columbium shows no sign of crystalline structure, is brittle, of a silver-white fracture, insoluble in hydrochloric or nitric acids, or aqua regia, but slowly soluble in boiling sulphuric or hydrofluoric acids. It is converted by molten alkali hydroxides into columbates, and is oxidised by the air into the pentoxide. Tantalum could not be obtained free from dross. It is



pure white and very hard, is completely insoluble in acids, but converted by alkali hydroxides into tantalates. It burns in the air to the pentoxide.

Pure metals could be obtained from the oxides of silicon, boron, tin, lead, titanium, or zirconium. Bismuth oxide reacts explosively with the alloy.

K. J. P. O.

**Combinations of Samarium Chloride with Gaseous Ammonia.** CAMILLE MATIGNON and R. TRANNOY (*Compt. rend.*, 1905, 140, 141—143).—When anhydrous samarium chloride (Abstr., 1902, ii, 505) is sealed in a tube with liquid ammonia, it is converted into a white, bulky compound,  $\text{SmCl}_3 \cdot 11.5\text{NH}_3$ , which, on being progressively heated, gives off its ammonia at eight different temperatures, which are the dissociation temperatures of the eight compounds that samarium chloride forms with ammonia; the formulæ of the compounds, their dissociation temperatures ( $t$ ), and heats of formation ( $Q$ ) are as follows:  $\text{SmCl}_3 \cdot \text{NH}_3$ , ( $t$ )  $375^\circ$ , ( $Q$ ) 20.7 Cal.;  $\text{SmCl}_3 \cdot 2\text{NH}_3$ , ( $t$ )  $240^\circ$ , ( $Q$ ) 16.4 Cal.;  $\text{SmCl}_3 \cdot 3\text{NH}_3$ , ( $t$ )  $200^\circ$ , ( $Q$ ) 15.1 Cal.;  $\text{SmCl}_3 \cdot 4\text{NH}_3$ , ( $t$ )  $155^\circ$ , ( $Q$ ) 13.7 Cal.;  $\text{SmCl}_3 \cdot 5\text{NH}_3$ , ( $t$ )  $105^\circ$ , ( $Q$ ) 12.1 Cal.;  $\text{SmCl}_3 \cdot 8\text{NH}_3$ , ( $t$ )  $76^\circ$ , ( $Q$ ) 11.2 Cal.;  $\text{SmCl}_3 \cdot 9.5\text{NH}_3$ , ( $t$ )  $40^\circ$ , ( $Q$ ) 10.0 Cal.;  $\text{SmCl}_3 \cdot 11.5\text{NH}_3$ , ( $t$ )  $15^\circ$ , ( $Q$ ) 9.2 Cal.

M. A. W.

**Double Silicides of Aluminium.** WILHELM MANCHOT and A. KIESER (*Annalen*, 1904, 337, 353—361).—A *chromium aluminium silicide*,  $\text{Cr}_2\text{AlSi}_3$ , is obtained by heating chromium, potassium dichromate, or potassium chromifluoride with a very large excess of potassium silicofluoride and aluminium in a Perrot's furnace to the highest attainable temperature for half an hour and dissolving the regulus in dilute hydrochloric acid. It forms greyish-white, hexagonal crystals with a metallic lustre, which are conductors of electricity; their hardness is 5 and sp. gr. 4.7. It is insoluble in sodium hydroxide, boiling hydrochloric acid, nitric acid, aqua regia, or sulphuric acid, but dissolves easily in hydrofluoric acid and molten alkali hydroxides. At a high temperature, chlorine, bromine, and iodine attack the material; hydrogen chloride has a feeble action and oxygen none.

If the proportions are so chosen that the regulus contains from 34.4 to 50 per cent. of free silicon, then a second *silicide*,  $\text{Cr}_2\text{AlSi}_4$ , is formed. It forms small crystals, of a hardness somewhat greater than 5, and a sp. gr. 4.8. It is partly dissociated at the temperature of formation. *Tungsten aluminium silicide* forms black, hexagonal crystals, which are not attacked by acids, aqua regia, or sodium hydroxide, and only by hydrofluoric acid on evaporation, but readily by hydrofluoric and nitric acids and by molten alkali hydroxides.

K. J. P. O.

**Indium and Rubidium Fluorides.** CAMILLE CHABRIÉ and A. BOUCHONNET (*Compt. rend.*, 1905, 140, 90—91. Compare Abstr., 1901, ii, 102, 242, 314, 600).—*Indium fluoride*,  $\text{In}_2\text{F}_{10} \cdot 18\text{H}_2\text{O}$ , obtained by slowly evaporating a heated solution of indium hydroxide in hydrogen fluoride, forms white, crystalline needles, very slightly soluble in cold

water, insoluble in alcohol or ether, soluble in cold hydrochloric or nitric acid, and slowly decomposed by boiling with water or exposure to the air; it loses its water of crystallisation when heated, and at a red heat is completely decomposed into indium sesquioxide and hydrogen fluoride. *Rubidium hydrogen fluoride*,  $\text{RbF} \cdot \text{HF}$ , obtained by slowly evaporating an aqueous solution of rubidium carbonate and hydrogen fluoride, forms small, deliquescent crystals, insoluble in alcohol or ether, and partially converted into *rubidium fluoride*,  $\text{RbF}$ , when heated with excess of ammonium hydrogen fluoride.

M. A. W.

**Interaction of Hydrochloric Acid and Potassium Permanganate in the Presence of Ferric Chloride.** JAMES BROWN (*Amer. J. Sci.*, 1905, [iv], 19, 31—38).—Experiments have been made in which known quantities of hydrochloric acid and of standard potassium permanganate solutions have been kept at  $50^\circ$  for a definite time. A known volume of standard oxalic acid was then added, and standard permanganate run in until the coloration was permanent. The amounts of permanganate apparently reduced during digestion are found constant in different experiments only when the chlorine produced during the digestion is expelled by a current of air or carbon dioxide before the addition of the oxalic acid. Ferric chloride was thought by Wagner (*Abstr.*, 1899, ii, 275) to have a catalytic influence on this reaction, but the author's experiments are opposed to this view.

J. C. P.

**The Increase in Volume of Molten Cast Iron saturated with Carbon in the Electric Furnace at the Moment of Solidifying.** HENRI MOISSAN (*Compt. rend.*, 1905, 140, 185—192).—Pure iron, or iron containing only a small quantity of carbon, behaves normally on passing from the liquid to the solid state, that is, its volume diminishes and its density increases; iron saturated with carbon in the electric furnace behaves like water on solidifying, that is, its volume increases and its density diminishes; when, however, fused cast iron of this type is rapidly cooled by immersion in water, in fused lead, or in iron filings, a solid crust is formed, and the liquid in the interior is subjected to increased pressure due (1) to the gas evolved during the change from the liquid to the solid state, (2) to the contraction of the solid crust on cooling, (3) to the increase in volume of the interior portion on passing from the liquid to the solid state, and in these circumstances microscopic diamonds are formed in the interior of the mass due to the cooling of the fused iron saturated with carbon under increased pressure (compare *Abstr.*, 1894, ii, 189; 1896, ii, 644). If, however, as sometimes happens, the interior pressure is released by the escape of gas through a weak place in a solid crust, no diamonds are formed.

M. A. W.

**A Colloidal Iron Hydroxide obtained by Electrodialysis, and some of its Properties.** J. TRIBOT and H. CHRÉTIEN (*Compt. rend.*, 1905, 140, 144—146).—The colloidal ferric hydroxide obtained by dialysing a solution of ferric hydroxide on ferric chloride

always contains a considerable quantity of chlorine, which can, however, be removed by an electrolytic process, the colloidal solution containing the cathode being placed in the inner cell, the outer vessel containing water which is frequently renewed. The colloidal ferric hydroxide thus obtained possesses all the properties of Graham's hydroxide; each form behaves as a ferment towards proteid matter in alkaline medium, breaking it down into albumoses, but the colloidal ferric hydroxide, prepared as above, is more active in this respect than that of Graham, as is shown in the following table:

Colloidal Solution.	Weight of Proteid.	Alkali added.	Percentage of Albumose formed.
50 c.c. electro-dialytic hydroxide	5.021	2 c.c. of $\frac{1.5\text{KOH}}{1000}$	27.02
50 c.c.           "           "	5.014	2 c.c. of $\frac{1.2\text{KOH}}{1000}$	24.62
50 c.c. Graham's hydroxide ...	5.073	2 c.c. of $\frac{1.5\text{KOH}}{1000}$	8.16
50 c.c.           "           "           ..."	5.041	2 c.c. of $\frac{1.2\text{KOH}}{1000}$	6.23

M. A. W.

**Colloidal Ferric Oxide, Brown Modification.** PAUL NICOLARDOT (*Compt. rend.*, 1905, 140, 310—312).—The fact that the majority of the crystallised ferric salts are white, leads the author to conclude that the normal sesquioxide should also exhibit this colour. It is, in fact, obtained in this condition when a freshly prepared and concentrated ferric solution is added to a cooled solution of ammonia, but it rapidly becomes coloured. To explain the differently coloured forms of the oxide, it is suggested that the normal colourless oxide undergoes molecular condensation. According to the author's statements, four such modifications can be recognised.

H. M. D.

**Ferrous and Ferric Arsenates.** WILLIAM DUNCAN (*Pharm. J.*, 1905, [iv], 20, 71—72).—Ferrous arsenate, prepared by the B.P. method, gradually undergoes oxidation. This change is due to the action of moisture, air, and heat, which results in the formation of ferric arsenate and oxide.

Ferric arsenate, when freshly precipitated, is a dull white, insoluble substance, which becomes grey when dried at 100°, and if heated above this temperature gradually turns red. The air-dried salt has the composition  $\text{FeAsO}_4 \cdot \text{H}_2\text{O}$ , but becomes anhydrous if heated at 100°. When either the hydrated or anhydrous salt is treated with sodium hydrogen carbonate, effervescence takes place and a soluble compound is produced. Hydrated ferric arsenate is therefore an acid, and determinations of its basicity have shown that it may be represented by the formula  $\text{AsO}_4(\text{FeO})(\text{OH})_2$ .

A ferrous ammonium arsenate has been prepared, but its stability has not yet been investigated.

E. G.



**Reduction of Molybdenum Compounds in Sulphuric Acid Solution by Magnesium.** BORIS GLASMANN (*Ber.*, 1905, 38, 604—605).—Molybdic acid in sulphuric or hydrochloric acid solution, is quantitatively reduced by magnesium to molybdenum trioxide.

A. McK.

**Physico-chemical Researches on Tin.** VI. ERNST COHEN and E. GOLDSCHMIDT (*Zeit. physikal. Chem.*, 1904, 50, 225—237. Compare Abstr., 1904, ii, 567).—Besides grey tin, the following modifications are mentioned in older chemical literature: (1) rhombic tin; (2) tetragonal tin; (3) recently fused tin.

Special determinations of the specific gravity show that no difference can be detected between tin prepared electrolytically and tin obtained in the usual way from the fused metal. In both cases, the tin crystallises in the tetragonal form. The specific gravity of recently fused tin is 7.287 at 15°, and it appears that the very low and irregular values obtained by earlier observers for the specific gravity of electrolytic tin were due to the enclosure of varying quantities of impurity such as stannous chloride. At the ordinary temperature, rhombic tin appears to be metastable, the transition temperature lying about 170°. No indication of this is given by a dilatometer, but there is a marked change in the rate of flow of compressed tin about that temperature (compare *Ann. Physik*, 1903, [iv], 10, 647). The various stable forms of tin and the temperature limits of their stability are indicated as follows:

Grey tin  $\xrightleftharpoons{20^\circ}$  tetragonal tin.

Tetragonal tin  $\xrightleftharpoons{170^\circ}$  rhombic tin.

Rhombic tin  $\xrightleftharpoons{233^\circ}$  fused tin.

J. C. P.

**Electrolytic Recovery of Tin.** F. GELSTHARP (*Trans. Faraday Soc.*, 1905, 1, 111—112).—When tin plates immersed in a solution of sodium hydroxide of sp. gr. 1.05 and at 80° were connected up with a battery, polarisation set in, and the anode surface was found to be covered with a layer of some brown substance. On reversing the direction of the current for a moment and again connecting up in the original manner, the polarisation disappeared and the tin dissolved regularly from the anode. The same effect was obtained by placing a piece of clean iron in contact with the anode for a short time.

Investigation of various pieces of tin plate showed that the phenomenon was exhibited by all bright clean samples, but not by old and tarnished (oxidised) pieces. The brown layer formed on the anode is supposed to be an oxide insoluble in sodium hydroxide solution; the effect of reversing the current or making contact with iron is to reduce this to finely divided metal, which, under the influence of the current, oxidises to form a soluble oxide. H. M. D.

**Tempering of Bronzes.** LÉON GUILLET (*Compt. rend.*, 1905, 140, 307—310).—Copper tin alloys, containing 5—21 per cent. of tin, have been tempered at temperatures varying from 300—800°, and the effect of the treatment on the mechanical properties determined. The

breaking weight and the elongation are slightly increased in the case of alloys containing more than 92 per cent. of copper by tempering at 400—600°. For alloys containing less than 92 per cent. of copper, these properties increase very distinctly when the temperature employed reaches 500°. This behaviour agrees with the facts brought forward by Heycock and Neville (*Abstr.*, 1901, ii, 508; 1902, ii, 261). The maximum breaking weight is reached by tempering at 600°; the temperature which gives the maximum elongation varies with the composition of the alloy, being 800° for a bronze containing 91 per cent. copper, and 600° for one containing 79 per cent. H. M. D.

**Copper, Tin, and Oxygen.** E. HEYN and O. BAUER (*Chem. Centr.*, 1905, i, 76—77; from *Mitt. Tech. Vers.-A. Berlin*, 1904, 22, 137—147).—The investigations of Heyn (compare *Abstr.*, 1904, ii, 406) on the equilibrium between copper and oxygen have been extended to the system copper, tin, and oxygen. Oxygen is only met with in copper tin alloys in the form of tin dioxide crystals, which are insoluble in the alloy. Occasionally the crystals unite to form pellicles, and as solidification proceeds the dioxide accumulates in the melted portion of the system, increasing its viscosity considerably. The tin dioxide pellicles resemble those of alumina in molten iron deoxidised by aluminium.

Cuprous oxide and tin cannot exist together in the molten alloy, reaction taking place according to the equation  $2\text{Cu}_2\text{O} + \text{Sn} = 4\text{Cu} + \text{SnO}_2$ . Addition of phosphorus is recommended for the removal of tin dioxide. For the analytical separation of the metallic tin from the dioxide, the alloy is made the anode in dilute sulphuric acid, when the tin present as metal passes into solution. Tin dioxide is insoluble in liquid tin. The grey and yellow spots observable on tin bronze fractures are due to the coarse structure consequent on slow cooling; if cooled rapidly, the colour of the fracture is quite uniform in consequence of the very intimate mixing of the particles. H. M. D.

**Electrolytic Preparation of Titanous Sulphate.** W. H. EVANS (*Mem. Manchester Phil. Soc.*, 1905, 49, Mem. II, 1—3. Compare *Abstr.*, 1904, ii, 412).—The effect of current density, concentration of solution and temperature on the electrolytic reduction of titanous sulphate was examined. Good yields of titanous sulphate could be obtained without the use of a diaphragm. If the current density at the anode is kept fairly high, oxygen is evolved without effecting any marked oxidation of the titanous salt. The yield diminishes rapidly with increase of current density. Rise of temperature increases the yield. A. McK.

**Condition in which Chlorine exists in Colloidal Solutions of Metallic Hydroxides.** RUDOLF RUER (*Zeit. anorg. Chem.*, 1905, 43, 85—93).—Colloidal solutions of zirconium hydroxide, prepared by dialysis of a 3 per cent. aqueous solution of zirconium oxychloride, contain chlorine. When silver nitrate is added to such solutions, only a faint opalescence appears, the solution becoming

gelatinous after a few minutes. When nitric acid is added along with silver nitrate, a slight turbidity appears, which becomes more marked when the solution is boiled, until finally all the silver is deposited as chloride. From this and from the analogous behaviour of ferric hydroxide, the conclusion is drawn that the colloidal solutions in question contained chlorine in the form of hydrochloric acid or metallic chloride or oxychloride, dissociation having occurred partially. The behaviour of the solutions towards silver nitrate is attributed to a specific action of the colloidal hydroxide by which the silver chloride formed is retained in solution in the colloidal form. The author's views are opposed to those of Hantzsch and Desch (Abstr., 1902, i, 708), who suppose that solutions of colloidal ferric hydroxychloride contain a complex chloro-ferric acid.

A. MCK.

**Radioactivity of Thorium.** FRITZ ZERBAN (*Ber.*, 1905, 38, 557—559. Compare Abstr., 1903, ii, 532; 1904, ii, 41; Winkler, Abstr., 1904, ii, 462).—Uranium has been found in all monazite sands which have been specially examined for that element. To ascertain if the monazite itself contains uranium, a well-crystallised Norwegian monazite was examined and found to contain uranium, and it yielded radioactive thorium. Minerals free from uranium yield inactive thorium (compare Baskerville and Zerban, this vol., ii, 95). G. Y.

**The Spitting of Alkali Vanadates.** WILHELM PRANDTL (*Ber.*, 1905, 38, 657—662).—When a mixture of vanadium pentoxide and sodium carbonate along with a small quantity of phosphoric acid is melted in the blow-pipe flame and allowed to cool slowly, a marked evolution of oxygen takes place, the whole mass spitting violently, much as solidifying silver does. *Sodium hypovanadovanadate*,  $5V_2O_5, V_2O_4, Na_2O$ , is formed, crystallising in dark steel-blue, glistening, rhombic needles quite insoluble in water; *potassium hypovanadovanadate*,  $8V_2O_5, V_2O_4, K_2O$ , has similar properties. This is an interesting case of dissociation of a compound rich in oxygen into oxygen and a substance containing less oxygen as the temperature falls.

E. F. A.

**So-called Explosive Antimony.** II. ERNST COHEN, EDWARD COLLINS, and TH. STRENGERS (*Zeit. physikal. Chem.*, 1904, 50, 291—308. Compare Abstr., 1904, ii, 345).—According to earlier work of Pfeifer and Popper, the quantities of metallic antimony deposited by a current from solutions of the trichloride are always proportional to the quantities of silver deposited by the same current; it was found also that this ratio was independent of the concentration of the antimony trichloride solution and of the varying quantities of the trichloride enclosed in the antimony deposit.

The authors show that the influence of varying temperature and of varying hydrochloric acid concentration on the electro-chemical equivalent found for antimony is practically negligible. Their experiments show, however, that the ratio Sb:Ag does increase with the concentration of the trichloride in the solution which is electrolysed; thus, as the said concentration rises from 2.3 to 83.3 per cent.



the antimony equivalent increases from 40.29 to 40.63. A similar increase of the equivalent was found with solutions of antimony trichloride in methyl alcohol, and of the tribromide and trifluoride in water. It is noteworthy that in the last case the antimony deposited is not explosive, nor does it enclose any appreciable quantity of the trifluoride. On the other hand, all the samples of antimony obtained by electrolysing the tribromide solutions (4.3—68.4 per cent. concentration) were explosive, and were found to contain large quantities of tribromide.

J. C. P.

**Alloys of Zinc and Antimony.** K. MÖNKEMEYER (*Zeit. anorg. Chem.*, 1905, 43, 182—196).—Since many of the results quoted in the literature concerning the compounds formed by melting together zinc and antimony are discordant, the author has studied the curve of cooling of mixtures of these metals.

The temperatures were measured by a thermo-element, the wires of which consisted of platinum and an alloy of platinum with rhodium and were connected by means of copper wires with a voltmeter. The temperatures were read every 10 seconds. Zinc melts at 410° and antimony at 630.6°.

From one series of experiments, the following are recorded: the composition of the molten mixture, the temperature at which crystallisation began (corresponding with the breaks in the curves of cooling), and the temperatures of the eutectic crystallisation (the simultaneous separation of two crystalline forms). The number of seconds is also noted during which each eutectic crystallisation lasted. The curve shows two maxima, three eutectic points, and the two melting points of the pure metals. The evidence for the existence of the compound  $\text{Zn}_3\text{Sb}_2$  is as follows. The curve exhibits a distinct maximum corresponding with 45 per cent. of zinc. At 561°, the temperature corresponding with this maximum, the solid which separates is uniform. The crystallisation of the fused masses, containing 50 and 40 per cent. of zinc respectively, ends at 411° and 539° respectively. The presence of the compound  $\text{Zn}_3\text{Sb}_2$  is also deduced from the structure of the alloys, containing from 40 to 50 per cent. of zinc.

The evidence for the existence of the compound  $\text{ZnSb}$  is as follows. The curve exhibits a maximum, corresponding with 35 per cent. of zinc, whilst at 544°, the temperature corresponding with this maximum, the solid which separates is uniform. The crystallisation of the fused masses containing 40 and 30 per cent. of zinc respectively ends at 539° and 507° respectively. The structure of the alloys is also evidence for the existence of this compound.

A. McK.

**Gold Hydrosols.** LUDWIG VANINO (*Ber.*, 1905, 38, 463—466. Compare Abstr., 1904, ii, 808).—Gold hydrosols may be prepared by warming alcoholic solutions of gold chloride with water. Sodium aurichloride is not reduced so readily. Hydrosols with different characteristic colours may be obtained by working under varying conditions of temperature and concentration. Methyl alcohol may be

used in place of ethyl alcohol, and the reaction may be carried out at the ordinary temperature, but proceeds very slowly under these conditions.  
J. J. S.

**Supposed Solubility of Aurous Oxide in Water.** LUDWIG VANINO (*Ber.*, 1905, 38, 462—463).—The so-called solution of aurous oxide in water is in reality a colloidal suspension, as the oxide may be precipitated together with barium sulphate or silicic acid (Vanino and Hartl, *Abstr.*, 1904, ii, 808), and cannot pass through a Puckall filter. It may also be recognised as a suspension by means of gum arabic (Muthmann, *Abstr.*, 1887, 636).  
J. J. S.

**Comparative Absorption of Hydrogen by Rhodium and Palladium.** L. QUENESSEN (*Bull. Soc. chim.*, 1905, [iii], 33, 191—193).—The author finds that Wilm's statements (*Abstr.*, 1881, 514), (1) that rhodium absorbs hydrogen more readily than palladium, (2) that the absorption capacity of rhodium for hydrogen varies with the method of preparation of the metal, and (3) that rhodium exhibits an affinity for hydrogen, are inaccurate.

Rhodium heated in a current of hydrogen absorbs a little of the gas, and, on exposure to air, the metal so treated gives rise to a small quantity of moisture, but no moisture is produced if, before the air is admitted, a current of dry cold carbon dioxide is passed over rhodium which has been heated in hydrogen. Further, rhodium previously heated in hydrogen evolves none of this gas when subsequently heated under reduced pressure. Palladium which has been heated in hydrogen and subsequently exposed to a current of cold dry carbon dioxide still retains the property of forming moisture when brought into contact with air.  
T. A. H.

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## Mineralogical Chemistry.

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**Gases Dissolved in Minerals.** K. HÜTTNER (*Zeit. anorg. Chem.*, 1905, 43, 8—13).—The gases evolved on heating separately a large number of different minerals in a porcelain tube at 800—850° in an atmosphere of carbon dioxide were collected in a Schiff's nitrometer containing a 50 per cent. solution of potassium hydroxide and analysed. The percentages of oxygen, carbon monoxide, hydrogen, and nitrogen respectively in the various mixtures are tabulated. The rare gases obtained in certain cases were not further investigated. The carbon monoxide found was not formed, as Gautier supposes, by the reduction of carbon dioxide by ferrous compounds, but by the reduction of carbon dioxide by hydrogen, nor was it present in solution in the original minerals. The hydrogen found was probably also not present in the original minerals.

Hydrogen and carbon monoxide are formed when minerals which contain water are heated in a current of carbon dioxide. Hydrogen is produced by the action of reducing agents, such as ferrous and manganoous compounds, on water vapour.  
A. McK.

[Graphite from Moravia. Nigrine (?) from Bohemia.] FRANTIŠEK KOVÁŘ (*Zeit. Kryst. Min.*, 1904, 39, 399; from *Zeit. chem. Ind. Prag.*, 1902, 6 pp.).—Graphite from Tresné, in Moravia: I, light grey, scaly; II, dark grey, finely scaly; III, blackish-grey, compact.

	C.	Ash.	Water (at 150°).	Water (comb.).	Total.
I.	58·07	38·45	1·08	2·40	100·00
II.	49·04	46·33	1·96	2·67	100·00
III.	33·63	62·40	1·77	2·20	100·00

Nigrine (?) occurring in orthoclase at Polanka, near Chrudim, in Bohemia, gave:

TiO <sub>2</sub> .	SiO <sub>2</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MgO.	Total.	Sp. gr.
70·05	0·76	28·30	0·62	0·12	99·86	4·48

L. J. S.

Composition of Fiedlerite. AUGUST B. DE SCHULTEN (*Compt. rend.*, 1905, 140, 315—316).—The mineral fiedlerite, found in 1887 as crystals in the ancient lead slags of Laurion, in Greece, has not hitherto been analysed. Analysis of colourless crystals gave the following results:

PbO.	Pb.	Cl.	H <sub>2</sub> O.	Total.	Sp. gr.
29·02	51·01	17·48	2·33	99·84	5·88

The formula  $\text{PbO}, 2\text{PbCl}_2, \text{H}_2\text{O}$  shows the relation of fiedlerite to laurionite ( $\text{PbO}, \text{PbCl}_2, \text{H}_2\text{O}$ ) and penfieldite ( $\text{PbO}, 2\text{PbCl}_2$ ), which are associated minerals in the Laurion slags.

Fiedlerite, when heated, decrepitates, becomes opaque, and loses its water at 150°. It is readily attacked by cold water, the transparent crystals soon becoming opaque.

L. J. S.

Salts from the Region of Lake Chad. H. COURTET (*Compt. rend.*, 1905, 140, 316—318).—The African desert in the neighbourhood of Lake Chad abounds in surface efflorescences of alkali salts. The salts noticed are thenardite ( $\text{Na}_2\text{SO}_4$ ), sodium chloride, and trona ( $3\text{Na}_2\text{O}, 4\text{CO}_2, 5\text{H}_2\text{O}$ ).

L. J. S.

New Mineral from the Asbestos Mines of the Lanterna Valley. LUIGI BRUGNATELLI (*Chem. Centr.*, 1904, ii, 1754; from *Rend. R. Inst. Lombardo Sci. Lett.*, 35, 869—874).—The new mineral has been found accompanying a form of peridotite, closely approximating to dunite. It occurs in the form of aggregates of small prisms imbedded in the latter, or of a white, earthy substance covering the asbestos mineral. Analysis gave:

MgO.	CO <sub>2</sub> .	H <sub>2</sub> O.
41·34	22·37	36·29



corresponding with the formula  $\text{MgCO}_3, \text{Mg}(\text{OH})_2, 3\text{H}_2\text{O}$ ; sp. gr. at  $16^\circ$  2.028, hardness 2—3; it appears to be monoclinic. The name *artinite* has been given to it.

H. M. D.

**Triplite from a New Swedish Locality.** IVAR NORDENSKJÖLD (*Zeit. Kryst. Min.*, 1904, 39, 390; from *Geol. För. Förh.*, Stockholm, 1902, 24, 412—414).—Triplite occurs in the quartz of a pegmatite-vein which is worked for felspar near the lake Lilla Elgsjön, in the parish Krokek, Government of Linköping. It is brown in colour and has the usual characters of triplite; analysis gave:

$\text{P}_2\text{O}_5$ .	F.	MnO.	FeO.	$\text{Fe}_2\text{O}_3$ .	MgO.	CaO.	$\text{Al}_2\text{O}_3$ .
32.05	8.72	35.23	18.43	2.38	4.46	2.10	0.37
	$\text{Na}_2\text{O}$ .	$\text{SiO}_2$ .	$\text{H}_2\text{O}$ .	Total (less O for F).			
	0.31	0.18	0.10	100.66			

L. J. S.

**Artificial Production of Hopeite.** AUGUST B. DE SCHULTEN (*Bull. Soc. franç. Min.*, 1904, 27, 100—103).—Small crystals of hopeite ( $\text{Zn}_3\text{P}_2\text{O}_8, 4\text{H}_2\text{O}$ ) are obtained by mixing solutions of zinc sulphate and disodium hydrogen phosphate, and by other methods. Larger crystals, suitable for the determination of the crystallographic and optical constants, were obtained by the following method: zinc phosphate, precipitated from solutions of zinc sulphate (45 grams  $\text{ZnSO}_4, 7\text{H}_2\text{O}$  in 0.5 litre) and disodium hydrogen phosphate (37 grams  $\text{HNa}_2\text{PO}_4, 12\text{H}_2\text{O}$  in 0.5 litre), is dissolved in a slight excess of sulphuric acid, the solution heated on a water-bath, and ammonia solution (3:100) added drop by drop; at the end of eight days, brilliant and limpid crystals, 4.4 mm. in length, were formed. The crystals are orthorhombic and have the characters of the natural mineral; sp. gr. 3.109.

L. J. S.

**Artificial Production of Barium- and Strontium-haidingerite.** AUGUST B. DE SCHULTEN (*Bull. Soc. franç. Min.*, 1904, 27, 104—109).—Crystals of the compounds  $\text{HBaAsO}_4, \text{H}_2\text{O}$  and  $\text{HSrAsO}_4, \text{H}_2\text{O}$  were obtained by a method similar to that described in the preceding abstract. The crystals of both are orthorhombic and isomorphous with the mineral haidingerite ( $\text{HCaAsO}_4, \text{H}_2\text{O}$ ) (compare Abstr., 1904, ii, 492).

L. J. S.

**Artificial Production of Barium-, Lead-, and Strontium-monetite, and of Arsenated Monetites.** AUGUST B. DE SCHULTEN (*Bull. Soc. franç. Min.*, 1904, 27, 109—123).—By the methods described in the preceding abstracts, crystals of the following compounds, isomorphous with the triclinic monetite ( $\text{HCaPO}_4$ ), were obtained, each of which is described crystallographically:  $\text{HBaPO}_4$  (orthorhombic),  $\text{HPbPO}_4$  (monoclinic),  $\text{HSrPO}_4$  (orthorhombic),  $\text{HSrAsO}_4$  (triclinic), and  $\text{HPbAsO}_4$  (monoclinic).

L. J. S.

**Artificial Production of Hureaulite and Cadmium-hureaulite.** AUGUST B. DE SCHULTEN (*Bull. Soc. franç. Min.*, 1904, 27, 123—129).—Monoclinic crystals of hureaulite ( $\text{H}_2\text{Mn}_3\text{P}_2\text{O}_8 \cdot 4\text{H}_2\text{O}$ ) and of the corresponding cadmium compound were obtained by the method described in the preceding abstracts. L. J. S.

**Artificial Production by a Wet Method of Anhydrous Chromates of Barium, Lead, and Strontium.** AUGUST B. DE SCHULTEN (*Bull. Soc. franç. Min.*, 1904, 27, 129—137).—Crystals, 1.2 mm. in length, of crocoite ( $\text{PbCrO}_4$ ) were obtained by adding a solution of potassium dichromate drop by drop to a warm solution of lead nitrate with concentrated nitric acid. Crystals of barium chromate ( $\text{BaCrO}_4$ ), which are orthorhombic and isomorphous with barytes, were obtained in a similar manner. Strontium chromate, being more soluble than the corresponding lead and barium chromates, is more difficult to obtain in measurable crystals, which are monoclinic and isomorphous with crocoite; the following method was successful: ammonia was added drop by drop for a period of thirty days to a warm solution of strontium nitrate and potassium dichromate. L. J. S.

**Formation of Oceanic Salt Deposits. XXXIX.** Temperatures of Transformation below  $25^\circ$ . JACOBUS H. VAN'T HOFF and WILHELM MEYERHOFFER (*Sitzungsber. K. Akad. Wiss. Berlin*, 1904, 1418—1421. Compare Abstr., 1904, ii, 492).—The temperature at which Glauber's salt is transformed into thenardite is normally  $32.4^\circ$ , but in presence of other salts the temperature is lower. Thus in presence of sodium chloride the transformation occurs at  $17.9^\circ$ , in presence of sodium chloride + glaserite at  $16.3^\circ$ , in presence of sodium chloride + blödite at  $15.3^\circ$ , in presence of sodium chloride + glaserite + blödite at  $13.7^\circ$ . Other components besides thenardite that disappear as the temperature falls are magnesium sulphate hexahydrate at  $13^\circ$ , kieserite at  $18^\circ$ , leonite at  $18^\circ$ , and blödite at  $4.5^\circ$ . J. C. P.

**Origin of Sodalite in Syenites.** STANISLAUS J. THUGUTT (*Centr. Min.*, 1905, 86—89).—The sodalite of sodalite-syenites has been considered by some authors to be of primary, and by others of secondary origin. It is pointed out that both sodalite and ultramarine (which is proved to be present in both blue and white sodalite) have been artificially prepared only by fusion, and that various attempts to obtain them by a wet method have been unsuccessful; further, sodalite is readily decomposed by water and aqueous solutions (Abstr., 1895, ii, 358). These facts are taken to prove that sodalite is always an original mineral of igneous origin. L. J. S.

[**Meerschaum and Jarosite.**] FRANTIŠEK KOVÁŘ (*Zeit. Kryst. Min.*, 1904, 39, 400; from *Progr. d. čechosl. Handels. akad. Prag.*, 1903, 13 pp.).—A finely fibrous to compact, pale yellow mineral, occurring in crevices in a felspar-hornblende-rock in western Moravia,

was shown on analysis to have the composition of meerschaum  
 $(\text{H}_4\text{Mg}_2\text{Si}_3\text{O}_{10})$  :

$\text{SiO}_2$ .	$\text{MgO}$ .	$\text{CaO}$ .	$\text{MnO}$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{H}_2\text{O}$ (comb.).*	$\text{CO}_2$ .	Total.
57.77	25.03	0.87	0.64	2.74	1.24	11.74	trace	100.00

\* 8.49 per cent. of hygroscopic water deducted.

Jarosite, as an ochre-yellow encrustation on hæmatite from Sichotín, in Moravia, gave :

$\text{Fe}_2\text{O}_3$ .	$\text{Al}_2\text{O}_3$ .	$\text{CaO}$ .	$\text{K}_2\text{O}$ .	$\text{Na}_2\text{O}$ .	$\text{SO}_3$ .	$\text{H}_2\text{O}$ .	Insol.	Total.
51.05	0.40	0.46	7.50	0.28	29.40	10.88	10.88	100.57

L. J. S.

**Titanolivine from Val Malenco, Lombardy.** LUIGI BRUGNATELLI (*Zeit. Kryst. Min.*, 1904, **39**, 209—219).—Nodules and veins of titanolivine occur with olivine, antigorite, magnetite, &c., in the serpentine-schists at several spots in the neighbourhood of Chiesa. It is a deep cherry-red in colour and resembles garnet in appearance ; sp. gr. 3.20—3.26. The optical characters of the material point to monoclinic symmetry, as previously suggested for the mineral by Lacroix. It is sometimes twinned, and is frequently regularly intergrown with olivine. The mineral offers more resistance to weathering than does the associated olivine, but the products of decomposition, namely, antigorite and a colourless diopside, are the same for both. Analysis by G. Anelli gave :

$\text{SiO}_2$ .	$\text{TiO}_2$ .	$\text{MgO}$ .	$\text{FeO}$ .	$\text{MnO}$ .	$\text{Fe}_2\text{O}_3$ .	F.	$\text{H}_2\text{O}$ .	Total.
36.86	4.78	45.50	10.05	trace	1.08	trace	1.57	99.84

The ratios  $(\text{Si,Ti})\text{O}_2 : \text{R}''\text{O} : \text{H}_2\text{O} = 1.06 : 2 : 0.14$  are almost identical with those obtained by Damour for the mineral from the Tyrol and Switzerland. Water is given off only at a high temperature. Titanolivine thus appears to be a distinct mineral species, and to be related to olivine as clinohumite is to humite.

L. J. S.

[**Hornblende from Bohemia.**] By HEINRICH L. BARVÍŘ (*Zeit. Kryst. Min.*, 1904, **39**, 398 ; from *Abh. böhm. Akad.*, 1902, No. 22).—In a paper on the chemical relations of some rocks from Eule, the following analysis is given of a hornblende, which was isolated from the granite of Zampach, near Eule :

$\text{SiO}_2$ .	$\text{TiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{FeO}$ .	$\text{MnO}$ .	$\text{CaO}$ .
44.16	trace	8.54	8.17	14.23	0.48	10.05
		$\text{H}_2\text{O}$	$\text{H}_2\text{O}$			
	$\text{MgO}$ .	(hygros.).	(ignition).	Total.	Sp. gr.	
	10.39	0.58	1.59	99.51	3.19	

L. J. S.

[**Chrysocolla from Western Australia.**] EDWARD S. SIMPSON (*Rep. Dep. Mines, W. Austr.*, for 1903, 1904, p. 143).—A supposed occurrence of turquoise with copper and gold ores has been reported



from the Murchison district. Although of a brilliant colour like turquoise, the mineral is shown by the following analysis to be chrysocolla, and not turquoise :

SiO <sub>2</sub> .	CuO.	FeO.	MgO.	Al <sub>2</sub> O <sub>3</sub> .	P <sub>2</sub> O <sub>5</sub> .	H <sub>2</sub> O at 100°.	H <sub>2</sub> O (ig- nition).	Total.
39·90	43·36	0·65	trace	nil	nil	9·36	7·42	100·69

The report includes various other mineralogical notes, and analyses of gypsum, diatomite, clay, and chalk.

L. J. S.

[**Alteration Product of Topaz.**] A. KREJČÍ (*Zeit. Kryst. Min.*, 1904, 39, 399; from *Sitz.-ber. k. böhm. Ges. Wiss.*, 1902, No. xxxv, 7 pp.).—The minerals beryl, tourmaline, andalusite, and topaz from Písek, in Bohemia, are described. The alteration product of the topaz is proved by the following analysis, by F. Kovář, to be compact muscovite.

SiO <sub>2</sub> .	F.	Fe <sub>2</sub> O <sub>3</sub> .	Al <sub>2</sub> O <sub>3</sub> .	MnO.	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.	Sp. gr.
47·71	0·17	2·87	33·61	1·10	trace	1·04	8·12	0·84	5·11	100·57	2·45

L. J. S.

[**Naëgite, a New Mineral.**] TSUNASHIRŌ WADA (*Minerals of Japan, Tōkyō*, 1904).—This book contains a description of all the mineral species found in Japan, with notes on their modes of occurrence and localities, and is an extension of the paper by K. Jimbō (Abstr., 1900, ii, 87). Numerous analyses which have hitherto not appeared in a European language, are quoted, and a new species, *naëgite*, is described.

The new mineral is found with fergusonite in the alluvial tin washings at Naëgi, near Takayama, in the province Mino, as green to brown spheroidal aggregates with indistinct crystals on the surface. The crystals are tabular or prismatic in habit, and appear to be tetragonal with the pyramid angle (111): ( $\bar{1}11$ ) about  $56\frac{1}{2}^\circ$ , which is near that of zircon. Under the microscope, the mineral is grass-green and transparent, and is sometimes optically birefringent, but more often isotropic. Hardness  $7\frac{1}{2}$ ; sp. gr. 4·09. It is pronouncedly radioactive. Analysis by T. Tamura gave:

SiO <sub>2</sub> .	UO <sub>2</sub> .	ThO <sub>2</sub> .	Ta <sub>2</sub> O <sub>5</sub> .	Nb <sub>2</sub> O <sub>5</sub> .	CoO <sub>2</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	H <sub>2</sub> O.	Total.
34·89	28·27	16·50	7·00	4·10	1·59	1·60	1·71	0·57	3·12	99·35

The mineral is thus mainly a silicate of uranium and thorium, and is considered to be isomorphous with zircon and thorite [but it is to be noted that the composition deviates very considerably from that of an orthosilicate].

L. J. S.

**Beckelite, a Calcium Cero-lanthano-didymo-silicate.** JÓZEF MOROZEWICZ (*Bull. Acad. Sci. Cracovie*, 1905, année 1904, 485—492).—The new mineral occurs as an accessory constituent of a dyke-rock composed of nephelite, albite, ægirite and magnetite, which is associated with the mariupolite (Abstr., 1902, ii, 668) and elæolite-syenites of the Mariupol district on the Sea of Azov, Russia. The wax-yellow grains

and octahedral or rhombic-dodecahedral crystals, which measure up to  $\frac{1}{2}$  cm. across, resemble pyrochlore in general appearance and physical characters, but have a cubic instead of an octahedral cleavage. Sp. gr. 4.15; hardness 5. The mineral is readily decomposed by acids with separation of silica. Chemically, it is quite distinct from pyrochlore, containing no niobium, titanium, or fluorine. Analysis gave:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	ZrO <sub>2</sub> .	Y <sub>2</sub> O <sub>3</sub> , Er <sub>2</sub> O <sub>3</sub> .	Ce <sub>2</sub> O <sub>3</sub> .	La <sub>2</sub> O <sub>3</sub> .	Di <sub>2</sub> O <sub>3</sub> .
17.13	0.30	trace	2.50	2.80	28.10	13.60	18.00
Mn <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	Loss on ignition.		Total.
0.07	15.46	trace	0.39	0.78	0.99		100.13

The formula is  $\text{Ca}_3(\text{Ce,La,Di,Y})_4(\text{Si,Zr})_3\text{O}_{15}$ , which, written as  $\text{Ca}_3\text{R}_2\text{Si}_3\text{O}_{12}, \text{R}_2\text{O}_3$ , shows a relation to garnet, with rare earths in place of alumina, and an analogy to calcium alumino-silicate.

L. J. S.

**Orbicular Gabbro from California.** ANDREW C. LAWSON (*Bull. Dept. Geol. Univ. California*, 1904, 3, 383—396).—A petrological description is given of the various facies of an outcrop of gabbro at Dehesa, San Diego Co. The normal type is a coarse-grained hornblende-gabbro with olivine and hypersthene. The spheroids of the orbicular type measure about 6 cm. across, and consist of a core of felspar surrounded by concentric shells of radially crystallised olivine and felspar. Analysis of the spheroids gave the results under I (by J. W. Howson), and of the felspar (anorthite) isolated from them the results under II (by W. T. Schaller):

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	FeO.	MgO.	CaO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	Total.
40.08	22.86	11.96	12.40	11.41	1.26	0.38	100.35
44.39	36.55	trace	nil	18.67	0.83	—	100.44

L. J. S.

## Physiological Chemistry.

**The Power of Human Blood to Decompose Hydrogen Peroxide.** HERMANN SILBERGLEIT and MAX MOSSE (*Chem. Centr.*, 1905, i, 268—269; from *Beitr. klin. Med. Festschrift*, 1904).—The same amount of hydrogen peroxide is decomposed in the same time by the same amount of blood from healthy people with the normal amount of haemoglobin and corpuscles. The catalytic power of the blood runs parallel with the number of corpuscles.

W. D. H.

**Peptic and Tryptic Digestion of Proteids. II.** D. LAWROFF (*Zeit. physiol. Chem.*, 1905, 43, 447—463).—The prolonged action of

0.5 per cent. hydrochloric acid leads to the formation, only more slowly, of the same products as those formed during peptic digestion. The experiments were mainly performed with gelatin and hæmoglobin.

W. D. H.

**Pancreas and Glycolysis.** RICHARD CLAUS and GUSTAV EMBDEN (*Beitr. chem. Physiol. Path.*, 1905, 6, 214—231. Compare Cohnheim, *Abstr.*, 1903, ii, 738; 1904, ii, 675).—Polemical, mainly against Cohnheim's view that the pancreas exercises power in promoting glycolysis in muscle. Cohnheim's results are not confirmed.

W. D. H.

**Physiology of Mollusca. I.** LAFAYETTE B. MENDEL and HAROLD C. BRADLEY (*Amer. J. Physiol.*, 1905, 13, 17—29).—Digestion in *Sycotypus* is effected by the salivary glands and the hepato-pancreas. The former histologically resemble those of higher animals; their secretion contains mucin and a proteolytic enzyme which normally acts in the cold and in solutions which are neutral or amphoteric; it closely resembles trypsin. The liver or hepato-pancreas contains an amylase, invertase, and lipase. Digestion occurs in the stomach and in the hepatic ducts; absorption occurs in the same situations.

W. D. H.

**Movements of the Alimentary Canal after Section of Nerves.** W. B. CANNON (*Proc. Amer. Physiol. Soc.*, 1904, xxii; *Amer. J. Physiol.*, 13).—X-Ray observations were made on the movements of the food mixed with bismuth subnitrate. After vagu ssection, there is stasis in the œsophagus, and the advance from the stomach is a little slowed, but almost normal. Stomach and intestinal movements also continue after cutting the splanchnics. The stomach movements are inhibited by distress in both conditions. The difference in the rate of discharge of carbohydrates and proteids was also preserved in both conditions.

W. D. H.

**Carbohydrate Combustion in the Animal Organism.** JULIUS STOKLASA (*Ber.*, 1905, 38, 664—670. Compare Stoklasa and Czerný, *Abstr.*, 1903, ii, 320, and 1904, i, 275).—It is shown that the crude enzymes obtained from previously frozen muscles possess practically no activity as compared with the enzymes separated from the same parts when fresh and unfrozen. Special experiments were made to show that the fermentative action is not due to bacteria as suggested by Cohnheim (this vol., ii, 675). Experiments, which will be described later in detail, have shown that in the decomposition in presence of air of carbohydrates by the enzymes of muscle extract, in addition to lactic acid, alcohol, and carbon dioxide, there are formed acetic acid, a little formic acid, and hydrogen. A hypothetical scheme of the degradation of dextrose by the enzymes in question is appended.

W. A. D.

**Physiological Economy in Nutrition.** RUSSELL H. CHITTENDEN (published in book form, 1904, 1—478, New York).—A full account of experiments carried out on the author's own person, on that of his



colleagues and students, and on soldiers and athletes. Each experiment lasted for many months. The diet taken, the excreta, the body weight, the general health, tests of strength, and of mental sharpness are the points mainly considered. The general conclusion reached is that the proteid intake may be reduced to one-half or one-third of the usually accepted standard, not only without harm, but with great advantage; equilibrium is maintained, health improves, bodily and mental vigour increase. Modern diet is condemned as not merely uselessly excessive, but positively harmful. The importance of the question, and of the results attained, can hardly be exaggerated. W. D. H.

**Gelatin as a Substitute for Proteid in Food.** J. R. MURLIN (*Proc. Amer. Physiol. Soc.*, 1904, xxix—xxx; *Amer. J. Physiol.*, 13).—In dogs, it is a matter of indifference how much of the proteid-nitrogen is replaced by gelatin-nitrogen up to one-half of the starvation requirement. Even if two-thirds is replaced, equilibrium is maintained provided the carbohydrate amounts to one-half to two-thirds of the calorific requirement. Corresponding results were obtained in man.

W. D. H.

**Proteid Synthesis in the Animal Body.** VALDEMAR HENRIQUES and C. HANSEN (*Zeit. physiol. Chem.*, 1905, 43, 417—446).—From experiments on rats, it was found that the products of decomposition of casein formed by acids will not maintain the body in nitrogenous equilibrium, even if given in large quantities, but that if the products are obtained by means of proteolysis by trypsin and erepsin, nitrogenous equilibrium is maintained, or nitrogen may even increase. The same is true for the products of tryptic digestion, which are not precipitable by phosphotungstic acid (monoamino-acids), and for those products which are soluble in warm 96 per cent. alcohol. The products which are insoluble in alcohol do not possess this property.

W. D. H.

**Influence of Carbohydrate Diet on the Composition of the Child.** FRANZ STEINITZ and RICHARD WEIGERT (*Beitr. chem. Physiol. Path.*, 1905, 6, 206—213).—An opportunity arose of making analyses of four infants who had died from malnutrition, due to an excess of carbohydrate in the food. The analyses bring out a low percentage of water and salts, and a high percentage of fat.

W. D. H.

**Effect of Blood on the Kidney.** TORALD SOLLMANN (*Proc. Amer. Physiol. Soc.*, 1904, xxxi; *Amer. J. Physiol.*, 13).—Viscid solutions of egg-white and gum acacia markedly decrease vein and ureter flow and kidney volume. Dilute defibrinated blood produces the same effect several days after excision. If freshly excised kidneys are used, the vein-flow is increased; the dilator effect is also produced by blood saturated with carbon monoxide, by blood laked at 63°, and by serum; it is destroyed by coagulating the proteids. The effects, however, vary with different kidneys and different samples of blood. Hydro-

cyanic acid is also a dilator ; so also is adrenaline under certain conditions. W. D. H.

**Effects of Isotonic Solutions on the Kidney.** TORALD SOLLMANN (*Proc. Amer. Physiol. Soc.*, 1904, xxx ; *Amer. J. Physiol.*, 13).—Excised kidneys were perfused with solutions isotonic with 1 per cent. sodium chloride solution. Cane sugar and dextrose cause very slight changes. Alcohol and urea diminish the vein and ureter flow and the kidney volume ; they penetrate the cells. In regard to cations, barium, calcium, and hydrogen produce the same effect ; magnesium increases both flows ; potassium and ammonium have little or no effect. In regard to anions, sulphate and citrate increase, and hydroxide, carbonate, and hydrogen carbonate lessen the flow. All these effects are removable by subsequent perfusion with sodium chloride. Locke's solution (*minus* the sugar) causes a slight increase of ureter flow, without changes in the venous flow or kidney volume. These effects can be produced several days after excision. W. D. H.

**Rate of Absorption from Intra-muscular Tissue.** S. J. MELTZER and JOHN AUER (*Proc. Amer. Physiol. Soc.*, 1904, xxxii—xxxiii ; *Amer. J. Physiol.*, 13).—Absorption from the intra-muscular tissue is incomparably more rapid and efficient than from the subcutaneous tissue. W. D. H.

**Alcohol in Animal Organs.** MAURICE NICLOUX (*Zeit. physiol. Chem.*, 1905, 43, 476. Compare Abstr., 1904, ii, 595).—Landsberg (Abstr., 1904, ii, 499) has confirmed in the main the author's previous results by his method. The present communication relates to some details in technique. W. D. H.

**Physiology of Glycogen.** WERA ADAMOFF (*Zeit. Biol.*, 1905, 46, 281—301).—Chickens just out of the shell contain little or no glycogen. Four days later, the glycogen begins to increase. New-born rabbits yield 4.36 grams of sugar from glycogen per kilo. of body weight ; this amount is small compared to that in well-fed adult dogs. The human liver from later fœtal periods contains glycogen, but not more than is obtainable from an adult animal in a state of inanition. Abundance of glycogen is therefore not a characteristic of embryonic tissues. The energy of growth and amount of glycogen are not related. W. D. H.

**Lactic Acids in the Animal Organism.** G. MORIYA (*Zeit. physiol. Chem.*, 1905, 43, 397—401).—The statement is generally made on the authority of W. Müller (*Annalen*, 1857, 103, 152) and of Gscheidlen (*Pflüger's Archiv*, 1874, 8, 178) that the lactic acid obtained from the brain is not sarcolactic acid, but fermentation lactic acid. This, however, is incorrect ; the acid present is sarcolactic or *d*-lactic acid as in other organs. It was identified not only in the brain of several kinds of animals, but also in lymph glands, kidneys, thymus, spleen, pancreas, and thyroid. W. D. H.

**Para-lactic Acid.** ARTHUR R. MANDEL (*Proc. Amer. Physiol. Soc.*, 1904, xvi; *Amer. J. Physiol.*, 13).—After producing phloridzin diabetes in a fasting dog poisoned with phosphorus, the urine reaction changes from ammoniacal to acid (Lusk). It seemed possible that lactic acid, which is produced in phosphorus poisoning, and is probably the cause of the excess of ammonia in the urine, might be derived as a cleavage product of sugar which originates from proteid. If this is so, no lactic acid should be formed in diabetes, even although phosphorus poisoning is present. This is the case; the blood and urine of a fasting dog poisoned with phosphorus contained lactic acid; this disappears when diabetes is induced by phloridzin.

Ingestion of fermentation lactic acid in diabetes leads to a slight reduction of proteid metabolism, and therefore of sugar output. A synthesis of a small quantity of lactic acid into sugar also seems to occur.

W. D. H.

**Origin of Creatinine.** WALDEMAR KOCH (*Proc. Amer. Physiol. Soc.*, 1904, xix; *Amer. J. Physiol.*, 13).—The relation of the methyl groups of lecithin to that of creatinine suggested feeding experiments with lecithin added to a creatine-free diet; the amount of lecithin given varied from 0.5 to 7 grams a day, but the amount of creatinine only varied slightly. Excess of lecithin is probably stored, for it does not appear in the faeces. Another factor (proteid katabolism) is involved in supplying most of the nitrogen of the creatinine molecule.

W. D. H.

**The Source of Substances containing Sulphur in Animals.** JULIUS WOHLGEMUTH (*Zeit. physiol. Chem.*, 1905, 43, 469—475).—Cystin is regarded as a source of the gaseous products hydrogen sulphide, methyl mercaptan, and ethyl sulphide, as it is also of taurine and of sulphates, non-oxidised sulphur, and sulphites. The seat of formation is probably the intestine.

W. D. H.

**Histological Changes in Wool-fibre by the Prolonged Action of Water. Chemical Nature of the Wax of Corpses.** NAZARENO TARUGI (*Gazzetta*, 1904, 34, ii, 469—474).—The author has examined the woollen sock of a drowned man who had remained under water for more than 22 months. The boot had prevented the swelling of the foot, which had taken up the shape of the boot. The total absence of any part of the sock outside the boot showed that the continuous action of the water had completely destroyed the woollen tissue by slow oxidation processes and mechanical action. The part of the sock inside the boot had been kept intact by a substance which had filtered into the wool, and which the author finds to consist mainly of palmitic acid. This acid is formed by the slow oxidation of the fatty substance of the foot.

T. H. P.

**Staining Reactions of Animal Cells.** MAX MOSSE (*Chem. Centr.*, 1905, i, 386; from Salkowski's *Festschrift*, 1904).—The paper mainly treats of histological methods, and especially of the different solubilities and staining reactions of nuclein and paranuclein (nucleoli).



Acid dyes are stated to colour the nuclein, and ammoniacal dyes the paranuclein, best. Absolute alcohol and then mercuric chloride are the best indifferent fixatives.

W. D. H.

**Reversal of Ciliary Movement in Metazoa.** G. H. PARKER (*Amer. J. Physiol.*, 1905, 13, 1—16).—The reversal of the effective stroke in the cilia of protozoa is well known. It is rarer in metazoa. The present experiments were made in the labial cilia of the anemone *Metridium marginatum*. The majority of the substances tried produce no effect. Reversal is not produced by changes in osmotic pressure, nor by anions, but by potassium-ions. The reversal observed with crab meat juice depends on organic compounds of potassium; if the extractives are removed, crab meat has no effect.

Irreversible cilia are probably not symmetrical, in that they consist of a supporting elastic element, on one side of which is contractile material.

W. D. H.

**Eck's Fistula in Dogs.** PHILIP B. HAWK (*Proc. Amer. Physiol. Soc.*, 1904, xiv; *Amer. J. Physiol.*, 13).—This operation was successfully performed in two dogs, who lived for 59 and 30 days respectively. The liver function was much impaired. The dogs lost greatly in body weight, and exhibited ataxy and cataleptic attacks while they lived. Feeding with sodium carbamate, or injection of this salt into the blood stream of normal dogs, did not produce these symptoms.

W. D. H.

**Iron in Mother's Milk.** WILLIAM CAMERER (*Zeit. Biol.*, 1905, 46, 371).—As an addition to former data, fresh analyses are given of a specimen of human milk from the third to the twelfth days of lactation. In one analysis, 100 c.c. of milk contained 21 mg. of  $\text{Fe}_2\text{O}_3$ , and 100 grams of ash contained 66.4 mg. In a second analysis, the numbers were 0.13 and 50.2 respectively.

W. D. H.

**Formation of Acids by Enzymes.** J. E. HINKINS (*Amer. Chem. J.*, 1905, 33, 164—167).—A series of experiments has been made to determine the action of diastase and pancreatin on solutions of triacetyldextrose in presence of peptone. The results show that in each case the solutions gradually become acid. A study was also made of the combined effect of bacteria and enzymes on the solution. It was found that when the liquids containing diastase or pancreatin were treated with cultures of bacteria taken from the mouths of persons having severe tooth erosion and were kept at  $37^\circ$ , a larger amount of acid was produced than in the absence of the bacteria. It is shown that solutions rendered acid by the action of enzymes readily dissolve cements employed for tooth fillings. It is concluded that the abnormal increase in the acidity of the saliva of persons suffering from tooth erosion is probably due to the action of enzymes on certain constituents of the saliva.

E. G.

**Normal Urine.** OTTO FOLIN (*Amer. J. Physiol.*, 1905, 13, 45—65, 66—115).—The tables giving the composition of normal

urine in most text-books are derived from the old analyses of Parkes, and thus date from a time before the introduction of the Kjeldahl method, and before the importance of the estimation of total nitrogen was recognised. Bunge calls attention to the fact that in the voluminous literature on the urine there is still no record of the complete analysis of any one concrete sample of a normal 24 hours' urine. Hopkins points out the importance of the urinary analysis being considered in relation to the diet. The first of the present papers aims at repairing this gap in statistics, the second deals with the laws governing the composition of normal urine. Complete analyses are presented of thirty urines from six normal persons, all kept for seven days on a uniform diet; the urine in each case was analysed for the last five days only of the period. The diet contained 119 grams of proteid, 148 of fat, and 225 of carbohydrate, that is, it approximates to the old Voit standard. The estimations made were of total nitrogen, urea, ammonia, creatinine, uric acid, chlorides, phosphates, total sulphur, sulphates of both kinds, "neutral sulphur," indican, total acidity, and mineral acidity.

The final averages for the 24 hours' urine are as follows :

Volume of urine	...	...	...	1430 c.c.
Total nitrogen	...	...	...	16 grams.
Urea...	...	...	...	29.8 "
Urea nitrogen	...	...	...	13.9 "
Ammonia nitrogen	...	...	...	0.7 "
Creatinine	...	...	...	1.55 "
Creatinine nitrogen	...	...	...	0.58 "
Uric acid	...	...	...	0.37 "
Uric acid nitrogen	...	...	...	0.12 "
Undetermined nitrogen	...	...	...	0.60 "

The following are the results in percentages of total nitrogen : urea, 87.5 ; ammonia, 4.3 ; urea and ammonia, 91.8 ; creatinine, 3.6 ; uric acid, 0.8 ; undetermined, 3.75.

The results regarding non-nitrogenous constituents are :

Total sulphur as $\text{SO}_3$	...	...	3.31 grams.
Inorganic $\text{SO}_3$	...	...	2.92 "
Ethereal $\text{SO}_3$	...	...	0.22 "
"Neutral" $\text{SO}_3$ ...	...	...	0.17 "
Acidity	...	...	617 c.c. of $N/10$ solution.
Mineral acidity	...	...	304 "
Organic acidity	...	...	313 "
Total phosphates...	...	...	3.87 grams $\text{P}_2\text{O}_5$ .
Chlorine	...	...	6.1 grams
Indican (Fehling's solution = 100)	...	...	77

The average weight of the people investigated was 63.4 kilos.

The numbers correspond very well to what has hitherto been considered normal.

The question next arises, what should be considered normal? The foregoing can only be considered normal on the basis of Voit's normal diet.

But there are races of mankind who take a very different diet, and yet are normal. There are individuals like vegetarians, and those who for various reasons have reduced their diet, particularly so far as proteid is concerned, much below the Voit standard; they remain normal, but their urine has a very different composition. The urine of one such person gave total nitrogen 4 to 8 grams; urea nitrogen, 62 to 80; ammonia nitrogen, 4.2 to 11.7; creatinine nitrogen, 5.5 to 11.1; uric acid nitrogen, 1.2 to 2.4; undetermined, 4.8 to 14.6 per cent. of total nitrogen. The wide variations were due to temporary changes in the diet, but the low urea value and the higher values of the other nitrogenous constituents would more accurately represent the usual condition on the subject's usual diet.

What is particularly noticeable in such persons is the comparatively low value of the urea nitrogen, and the first law laid down is that the distribution of the nitrogen depends on the absolute amount of total nitrogen present. There are similar differences in the distribution of the sulphur, and a similar rule is laid down. The amount of creatinine is specially interesting; on a nitrogen-rich diet, it only accounts for 3.6 per cent. of the nitrogen, whereas on a diet poor in nitrogen the urea nitrogen may sink to 62 per cent. and the creatinine nitrogen rise to 11 per cent. of the total. The absolute quantity of creatinine excreted in the same person on both diets is the same; there are individual differences between different people; corpulent people excrete less than thin people. Creatinine excretion is an index of one kind of proteid metabolism, and demands further study. Burian and Schur reached a very similar conclusion regarding endogenous purine. The conclusion drawn from the present work regarding uric acid is that the excretion of this substance in reduced proteid metabolism is diminished, but not nearly in proportion to the total nitrogen, hence the percentage of uric acid nitrogen is increased. A clear line of division between endogenous and exogenous purine, as postulated by Burian and Schur, was not wholly confirmed in the present work. With regard to ammonia, the following general conclusion is drawn: a pronounced reduction of the total nitrogen is accompanied by a relative rise in ammonia nitrogen, provided the food is not such as to yield an alkaline ash; and further, the absolute quantity of undetermined nitrogen increases under the influence of a diet poor in nitrogen, but there is a relative increase.

The only nitrogenous substance which suffers a relative as well as an absolute decrease with nitrogen-poor food is urea; the percentage of urea-nitrogen in normal human urine, as well as in nearly all pathological urine, is often reduced to 60 per cent. of the total. A further reduction is probably abnormal, although that is still unsettled.

Urinary indican is an approximate measure of intestinal putrefaction; the ethereal sulphates are not so, being only partly produced in this way; they represent a form of sulphur metabolism which becomes more prominent when the food contains but little proteid; the neutral sulphur is not at all due to processes similar to those which give rise to indican, but is in the main independent of the total sulphur and of katabolised proteid. Accurate sulphur determinations are, however, at present beset with errors of technique.

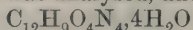
The volume of urine depends directly on the amount of water taken



in; variations not due to variations of intake are related to the reciprocal action of the skin. Provided the chloride intake is constant, the chlorine elimination varies with the volume of the urine.

The phosphates in clear acid urine are all monobasic; the acidity is ordinarily greater than the acidity of all the phosphates, the excess being due to free organic acids; the mineral acidity decreases, and often is a *minus* quantity on a proteid-poor diet. The organic acids do not diminish so much. W. D. H.

**Urine of the Coyote.** ROBERT E. SWAIN (*Amer. J. Physiol.*, 1905, 13, 30—34).—Kynurenic acid has hitherto been found only in dog's urine; it is absent even in the fox and wolf. It is, however, present in the urine of the coyote, an animal closely related to the dog and inhabiting the arid districts of N.W. America. The total nitrogen is 36.4 grams per litre, most of which is present as urea. The amount of kynurenic acid is 0.4 gram per litre. A crystalline deposit found in the urine was analysed, and the formula



assigned to it. Jaffe's urocanic acid has the formula  $\text{C}_{12}\text{H}_{12}\text{O}_4\text{N}_4, 4\text{H}_2\text{O}$ . Further investigation of this new material is promised. W. D. H.

**Acidity of Urine.** HEINRICH DRESER (*Beitr. chem. Physiol. Path.*, 1905, 6, 178—190).—What is termed the intensity of acidity is regarded as an important factor in the therapeutic action of urinary disinfectants, such as camphoric and salicylic acids. In acid human urine, the acidity obtained by titration with alkali is often twice or thrice as great as that reckoned from the amount of acid phosphate. The urinary acidity cannot therefore depend on a mixture of primary and secondary alkali phosphates. W. D. H.

**Elimination of Creatinine.** LAFAYETTE B. MENDEL and OLIVER E. CLOSSON (*Proc. Amer. Physiol. Soc.*, 1904, xix—xx; *Amer. J. Physiol.*, 13).—Data on this question are meagre and conflicting. There is a noteworthy excretion of this substance in vegetarians and those on a low proteid diet. On a creatine-free diet, there is a tendency to parallelism between total nitrogen output and the excretion of creatinine. W. D. H.

**Urea in Human Urine.** WILLIAM CAMERER (*Zeit. Biol.*, 1905, 46, 322—370. Compare Abstr., 1903, ii, 688).—A critical analysis of methods and results. W. D. H.

**Bence-Jones Proteid.** LUGWIG LINDEMANN (*Chem. Centr.*, 1905, i, 269—270; from *Arch. klin. Med.*, 81, 114—118).—A case in which this proteid occurred in the urine is described. Its characters resemble those described by others in the main. It is regarded as an albumose. W. D. H.

**Behaviour of *p*-Dimethylaminobenzaldehyde in Animal Metabolism.** MAX JAFFÉ (*Zeit. physiol. Chem.*, 1905, 43, 374—396).—*p*-Dimethylaminobenzaldehyde, dissolved in hydrochloric acid, is a

reagent which gives a red colour with normal urine; this reaction is increased in certain pathological cases, mainly of abdominal disease. What substance in urine gives the colour is uncertain. If the drug itself is given to rabbits, it is excreted mainly in combination with glycuronic acid, but among other substances found also in the urine are *p*-dimethylaminobenzoic acid and *p*-methylaminobenzoic acid.

W. D. H.

**Pigments originating from Scatole and the Scatoxyl Question.** CH. PORCHER and CH. HERVIEUX (*J. Pharm. Chim.*, 1905, [vi], 21, 55—65. Compare Abstr., 1904, [ii], 577).—The chromogen appearing in the urine, after administration of scatole, on a milk diet, is, in the authors' opinion, a derivative of a scatoxyl, probably

$\text{C}_6\text{H}_4 \begin{array}{c} \text{CHMe} \\ \diagup \quad \diagdown \\ \text{NH} \end{array} \text{CO}$ . It is not, as supposed by Maillard, indirubin.

The colour due to scatole differs from those due to indole in its insolubility in chloroform, and, further, it is withdrawn by dilute alkali from the amyl alcohol solution, being reproduced on acidification.

G. D. L.

**Diabetes Mellitus.** GRAHAM LUSK and ARTHUR R. MANDEL (*J. Amer. Med. Assoc.*, July, 1904; *Deut. Archiv. klin. Med.*, 1904, 81, 472—492).—A rapidly fatal case of diabetes is recorded. There was low acidosis, and a trace of albumin in the urine; on a meat diet, the dextrose : nitrogen ratio was 3.65 : 1. This is the same as in phloridzin diabetes in dogs, and was unaltered by fat digestion or fat metabolism. The sugar was derived from proteid alone. There was complete intolerance for carbohydrates; 85 per cent. of starch and 80 per cent. of lævulose given being excreted as sugar in the urine. Withdrawal of carbohydrate food had no effect on urinary nitrogen. Urea elimination was normal. The significance of the 3.65 : 1 ratio in a meat diet is very great. It indicates a rapidly fatal result.

W. D. H.

**Experimental Diabetes.** FRANK P. UNDERHILL (*Proc. Amer. Physiol. Soc.*, 1904, xxxvi; *Amer. J. Physiol.*, 13).—Piperidine causes diabetes and hyperglycæmia if painted on the pancreas, intraperitoneally or intravascularly injected. This substance and a number of others, including narcotics, various alkaloids, and possibly adrenaline, appear to have no particular influence on the pancreas, but probably act on the respiratory centre, producing dyspnoea and thus a diabetic condition secondarily.

W. D. H.

**Soaps in Certain Pathological Conditions.** OSKAR KLOTZ (*Proc. Amer. Physiol. Soc.*, 1904, xxi—xxii; *Amer. J. Physiol.*, 13).—In certain calcareous deposits, the centre is composed of calcium salts; the periphery contains potassium, sodium, and ammonium soaps. As degeneration continues, these are converted into calcium soaps, and finally into calcium phosphate and carbonate. Soaps may also be demonstrated in pus, and a calcium soap is formed during fat necrosis.

W. D. H.

**Behaviour of Guanine in the Rabbit.** ALFRED SCHITTENHELM and ERNST BENDIX (*Zeit. physiol. Chem.*, 1905, 43, 365—373).—Intravenous or subcutaneous injection of guanine dissolved in sodium hydroxide leads, in rabbits, to a great increase of purine substances, especially uric acid, in the urine.  
W. D. H.

**Action of Urotropin and Allied Compounds.** ARTHUR NICOLAÏER (*Chem. Centr.*, 1905, i, 283—284; from *Arch. klin. Med.*, 81, 181—223).—The use of urotropin and a number of similar compounds in the treatment of bacterial invasion of the urinary passages is attributed to the fact that in decomposition these substances yield formaldehyde. Urotropin methylenecitrate yields by heating much more formaldehyde than urotropin, but has no stronger effect on the urine than urotropin itself. This compound owes its therapeutic effect only to the urotropin it contains. Formaldehyde is also a solvent of uric acid.  
W. D. H.

**Ricin.** THOMAS B. OSBORNE and LAFAYETTE B. MENDEL (*Proc. Amer. Physiol. Soc.*, 1904, xxxii; *Amer. J. Physiol.*, 13).—The castor-bean proteids were fractionated by neutral salts into portions with great and slight toxicity, and ricin was prepared in a pure form. The toxic preparations sediment red corpuscles; this property is lost when the proteid is heated to coagulation point. Pure ricin can be kept for months without deterioration. After administration, toxic symptoms do not occur until after a latent period of 15 hours. The toxicity is enormously diminished if ricin is given by the alimentary canal.

W. D. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Influence of Calcium Sulphate on the Decomposition of Starch and Albumin in the Mashing Process.** WILHELM WINDISCH and H. BODEN (*Chem. Centr.*, 1905, i, 305; from *Woch. Brauerei*, 21, 775).—Calcium sulphate diminishes the diastatic power of malt, especially if previously weakened by high temperature or in mashing or kiln-drying, but does not act on yeast. Unfermentable decomposition products of starch are formed, but are converted into fermentable forms by *Mucor amylomyces Rouxii*, whilst with yeasts of high fermenting power such as *Schizosaccharomyces Pombe* no decrease is caused by calcium sulphate.

The nitrogen content of the wort is increased to an extent depending on the proportion of calcium sulphate and the temperature, commencing at 20° and attaining a maximum at 60°. The increase in nitrogen is about one-fifth, and is due to degradation products of albumin, particularly to amino-acids. Calcium sulphate facilitates the action of pepsin, and also the coagulation of the proteids.

G. D. L.



**Contribution to Cell Chemistry.** VICTOR C. VAUGHAN (*Proc. Amer. Physiol. Soc.*, 1904, xi—xii; *Amer. J. Physiol.*, 13).—Bacteria are washed with dilute alcohol and extracted with alcohol and then with ether. They are powdered and heated with sodium ethoxide. This splits the cells into two portions, A and B. A constitutes about a third of the cell substance; it is freely soluble in water and in alcohol, gives the proteid reactions, and contains the intracellular toxin of the bacillus. Animals treated with it yield an antitoxic serum. B is insoluble in alcohol, and animals treated with it furnish a bacteriolytic, but not an antitoxic serum. W. D. H.

**Action of Different Lactic Ferments on Cheese-ripening.** ED. VON FREUDENREICH and J. THÖNI (*Centr. Bakt. Par.*, 1905, ii, 14, 34—43).—The lactic acid bacteria have the chief rôle in cheese-ripening, but it is still uncertain which of them are the most favourable. As a rule, the best cheeses were those which contained the most decomposition products, and those which most resembled Emmenthaler cheese were found to contain *Bacillus*  $\epsilon$ , although *Bac.*  $\alpha$  also gave good results. *Bacterium lactis acidii* seems to be necessary.

When artificial rennet alone is employed, ripening does not go on so satisfactorily. The ripening is, however, normal when suitable bacteria are employed in conjunction with artificial rennet, and it is probable that in time this method will be found to be as beneficial as in the case of butter. N. H. J. M.

**Sensitiveness of Putrefactive and Lactic Acid Bacteria towards Poisons.** OTTO RAHN (*Centr. Bakt. Par.*, 1905, ii, 14, 21—25).—Putrefactive bacteria and mould fungi resist the action of poisons much more than lactic acid bacteria, except in the cases of menthol and sodium benzoate. Mercuric chloride, formalin, boric acid, and salicylic acid acted more strongly in boiled milk, whilst copper sulphate, sodium benzoate, phenol, and menthol were more active in pasteurised milk. Formalin had very little effect on mould fungi and yeast. N. H. J. M.

**Nitrogen-fixing Bacteria.** HUGO FISCHER (*J. Landw.*, 1905, 53, 61—66).—Out of six soil samples from differently manured plots, only two from the plots which had received lime were found to contain *Azotobacter*. The original soil is a heavy loam, with only 0.145 per cent. of lime. N. H. J. M.

**Presence and Distribution of Nitrogen-fixing Bacteria in the Sea.** KEUTNER (*Chem. Centr.*, 1905, i, 395; from *Wiss. Meeresunterss. Abt. Kiel*, 8).—The nitrogen-fixing bacteria *Azotobacter chroococcum* and *Clostridium Pasteurianum* are widely distributed in the ocean. The former still shows the power of fixing nitrogen in an 8 per cent. solution of sodium chloride. The bacteria are found on algae and on plankton organisms, and also occur in many fresh waters. G. D. L.

**Biochemical Mechanism of the Fermentation of Uric Acid.** CELSO ULPANI and M. CINGOLANI (*Gazzetta*, 1904, **34**, ii, 377—404. Compare Abstr., 1904, ii, 138 and 139).—The authors' experiments show that the uric acid bacterium only attacks and ferments substances the molecules of which consist of a three-carbon atom chain, of which the two outer carbon atoms are in the form of carboxyl, whilst the middle carbon atom can be more or less completely oxidised. Fermentation also occurs with compounds in which this molecular grouping is combined with the carbamide nucleus, but in this case the oxidation of the three-carbon atom chain is preceded by the detachment of the carbamide group, which undergoes no further change. The three acids derivable from the central axis of the uric acid molecule, namely, malonic, tartronic, and mesoxalic acids, undergo fermentation by the uric acid bacterium with different degrees of rapidity, malonic acid being least readily destroyed, and mesoxalic acid most readily.

T. H. P.

**Hydrogen Peroxide in the Nascent State. Bactericidal Action on Microbes in Water.** EDMOND BONJEAN (*Compt. rend.*, 1905, **140**, 50—52. Compare Abstr., 1903, ii, 319).—The amount of hydrogen peroxide required to sterilise a litre of Seine water was found to be 0.291 gram, the time being 6 hours. A much smaller amount (0.060 gram) of nascent hydrogen peroxide, from calcium peroxide, sterilised the water in 4 hours.

N. H. J. M.

**Action of Magnesium and of Magnesia on Microbes.** F. DIENERT (*Compt. rend.*, 1905, **140**, 273—275. Compare Abstr., 1903, ii, 447).—The addition of magnesium to water containing micro-organisms (Eberth's bacillus and *Bacillus coli communis*) kills the bacteria after two or three days, whilst pure magnesia under similar conditions has no destructive action on the organisms, although its presence in a culture of the bacilli retards their growth; if, however, the oxygen of the air be displaced by hydrogen or a vacuum be made over water containing micro-organisms, it is rendered sterile in two or three days.

M. A. W.

**Chemotaxis of Isoetes Spermatozoids.** K. SHIBATA (*Chem. Centr.*, 1905, i, 266—267; from *Ber. Deut. bot. Ges.*, **22**, 478).—The normal salts of malic acid and its optical isomerides at concentrations of  $N/20000$  and upwards exercise a powerful attraction on the spermatozoids of *Isoetes*. Normal succinates, fumarates, and tartrates act similarly, but less powerfully, whilst maleic and aminosuccinic acids, ethyl malate, and succinimide are without action. The sensibility is diminished by prior excitement. Free malic acid acts like the salts in very dilute solution, but repulsive effect increases with increasing concentration. The "critical concentration" at which the attractive force of a  $N/1000$  solution of sodium malate is just overcome is equivalent for mineral acids, organic acids also acting in proportion to the number of hydrogen ions. The negative chemotaxis of these ions is thus shown, hydroxyl ions behaving similarly. There is an optimum concentration for the malic ions, as also for other di- and tri-basic

organic acids, above which the attraction begins to change to a repulsion. The ions of various heavy metals cause a negative action.

Since the critical concentrations of alkali and alkaline-earth nitrates and sulphates are not isotonic, and since all substances, which do not act in a negative sense, produce no repulsion in any concentration, it would appear that there is no osmotaxic excitability.

The sensibility towards sodium malate is destroyed by ether, chloroform, or chloral hydrate, and is destroyed or diminished by some electrolytes.

There appears with the *Isoetes* spermatozoids to be phototaxis along with a typical topotaxis.

G. D. L.

**Acidity of Plant Roots.** CARLO MONTANARI (*Chem. Centr.*, 1905, i, 35; from *Staz. sper. agrar. ital.*, 37, 806—809. Compare Kohn, *Abstr.*, 1899, ii, 791).—The coloration observed by Kohn is only apparent, and similar results are obtained without roots. The reddening of litmus paper in contact with sugar beet roots is attributed to diffusion of the root acid.

N. H. J. M.

**Chlorophyllic Assimilation in Absence of Oxygen.** JEAN FRIEDEL (*Compt. rend.*, 1905, 140, 169—170. Compare *Abstr.*, 1903, ii, 171).—Chlorophyllic assimilation was found to be not appreciably altered by decreasing the amount of oxygen to 2 per cent. It is now shown that assimilation takes place when the atmosphere does not contain any oxygen at all. When a leaf of *Euonymus japonicus* was exposed to light in a tube containing carbon dioxide (17.89) and nitrogen (82.11 per cent.), oxygen was liberated and carbon dioxide was absorbed. After about 6 hours, the atmosphere of the tube contained 0.48 per cent. of carbon dioxide, 18.70 per cent. of oxygen, and 80.81 per cent. of nitrogen.

N. H. J. M.

**Assimilation of Carbon by Plants. I. Supposed Formation of Formaldehyde.** GIUSEPPE PLANCHER and C. RAVENNA (*Atti R. Accad. Lincei*, 1904, [v], 13, ii, 459—465).—The authors discuss the evidence which has been brought forward in favour of the preliminary formation of formaldehyde in the manufacture of starch by chlorophyll-containing plants. Experiments made on the distillation of extracts of leaves give no indication of the presence of either free or combined formaldehyde in the green tissues during the assimilation.

T. H. P.

**Forcing Experiments with Shrubs by means of Ether or Chloroform.** O. DRUDE, A. NEUMANN, and FRANZ LEDIEN (*Bied. Centr.*, 1905, 34, 33—35; from *Zeit. Obst. Gartenbau K. Sachsen.*, 1904).—Experiments with two varieties of *Syringa* kept for 3 days at  $-4^{\circ}$  showed that no accelerating action had taken place.

As regards the effect of ether, it was found that with a high temperature less ether need be employed. A second application of ether was found to be injurious. The favourable effect of ether ceases as the end of the year approaches, and by the end of November it may even be injurious. Plants etherised in the spring and kept in the



cold developed very few or no flowers, owing to the absence of the necessary reserve substances which would have accumulated during the period of rest of which the plants had been deprived.

The best amount of ether is 50 grams per hectolitre of air ; 75 grams are injurious, and 100 grams fatal. Chloroform is uncertain in its action, but gives good results if carefully employed. N. H. J. M.

**Psidium Guayava (Djamboe) Leaves.** A. ALTAN (*Chem. Centr.*, 1905, i, 265 ; from *Pharm. Post*, 37, 713).—The leaves have the percentage composition : resin, 3.15 ; fat, 5.99 ; volatile oil, 0.365 ; chlorophyll, 0.395 ; tannin, 9.15 ; mineral salts, 3.95 ; cellulose, 77.

The citron-yellow aromatic resin dissolves easily in chloroform, ether, or alcohol, melts at 189°, and has the iodine number 115, acid number 89, and saponification number 131. Alkalis colour it yellowish-red, and strong sulphuric acid produces a brown mass. The fat is yellowish-green, has a pleasant aromatic odour, and dissolves completely in chloroform, partially in ether or alcohol ; it melts at 235° and has an iodine number 199, acid number 95, and saponification number 137.

The greenish-yellow volatile oil contains eugenol and dissolves in chloroform, ether, or alcohol ; it boils at 237° and has a sp. gr. 1.069. Sulphuric acid colours it dark green, and bromine vapour orange-yellow. The tannin forms a brown, amorphous powder, soluble in water and alcohol, giving a black precipitate with iron salts and reducing alkaline copper solution after boiling with dilute sulphuric acid. Calcium and manganese are present in the plant in combination with phosphoric, oxalic, and malic acids. G. D. L.

**Lactolase, an Enzyme causing the Formation of Lactic Acid in Plant Cells.** JULIUS STOKLASA (*Chem. Centr.*, 1905, i, 265 ; from *Ber. Deut. bot. Ges.*, 22, 460).—The crude enzyme from the sap of the beet-root, potato, or pea causes vigorous alcoholic fermentation and the formation of lactic acid in dextrose solutions in the presence of 1 to 2 per cent. of toluene. This enzyme causes the formation of lactic acid during the respiration of the above plants and of the cucumber in the absence of micro-organisms.

When air has free access, and when the fermentation of the dextrose lasts more than 24 hours, hydrogen is evolved. The alcohol is oxidised by an enzyme to acetic acid, and at the same time formic acid is produced, and gives hydrogen and carbon dioxide. This hydrogen in the nascent state probably plays an important rôle in carbon dioxide assimilation by the chlorophyll-containing cells. G. D. L.

**Chemical Examination of Cascara Bark.** HOOPER A. D. JOWETT (*Reprint from Amer. Pharm. Assoc.*, 1904, 1—24).—An examination has been made of two samples of the bark of *Rhamnus purshianus*, one of which was comparatively fresh whilst the other was a commercial specimen which had been collected not less than three years previously. A specimen of the bark of *R. californicus* was also investigated. Each sample of bark gave practically the same results, which are summarised below.

The bark contains emodin together with a small quantity of an

isomeride which melts at  $183^{\circ}$ , but differs from emodin in being soluble in ammonia, and is possibly identical with *isoemodin* obtained from the bark of *Rhamnus frangula* (Thorpe and Miller, Trans., 1892, 61, 6); its *acetyl* derivative melts at  $168^{\circ}$ . Dextrose was found in the bark, and a substance which on hydrolysis with dilute sulphuric acid yields syringic acid, but no evidence could be obtained of the presence of chrysophanic acid, chrysarobin, or of glucosides yielding, on hydrolysis, emodin, chrysophanic acid, or rhamnetin, Schwabe's conclusions (Abstr., 1889, 68) being thus confirmed. Neither the "cascarine" of Le Prince (*Compt. rend.*, 1892, 115, 286) nor the "purshianin" of Dohme and Engelhardt (Abstr., 1898, ii, 629) could be isolated, and there can be no doubt that these substances were impure products. No substance corresponding with the crystalline material described by Prescott (*Amer. J. Pharm.*, 1879, 51, 165) could be obtained from the bark.

Cascara bark contains about 2 per cent. of a fat consisting of rhamnol arachidate, arachidic acid, and certain substances, probably glycerides, which on hydrolysis furnish linolic and myristic acids. Rhamnol,  $C_{20}H_{34}O$ , is identical with the alcohol obtained by Power and Lees (Abstr., 1903, i, 773) from the seeds of *Brucea sumatrana*; it crystallises in white needles, melts at  $135$ — $136^{\circ}$ , has  $[\alpha]_D - 31^{\circ}$  in chloroform at  $22^{\circ}$ , and is readily soluble in ether, chloroform, benzene, or hot alcohol, and sparingly so in cold alcohol, acetone, water, or glacial acetic acid; its *acetyl* derivative melts at  $117^{\circ}$ .

An enzyme was isolated from the bark which is capable of effecting the hydrolysis of amygdalin.

A series of physiological experiments was carried out, the results of which indicated that the active principle of the drug was contained in the product obtained by adding basic lead acetate to an aqueous solution of the alcoholic extract, which had been previously treated with lead acetate and filtered, submitting the precipitate to the action of hydrogen sulphide and extracting the product with ethyl acetate. On evaporation, the ethyl acetate solution yielded a dark red residue, readily soluble in alcohol or water, but no crystalline substance could be isolated.

E. G.

**Pigments of the Purple Pitcher Plant.** GUSTAVE M. MEYER and WILLIAM J. GIES (*Proc. Amer. Physiol. Soc.*, 1904, xxxiii—xxxiv; *Amer. J. Physiol.*, 13).—Alcohol extracts three colouring matters from the macerated pitchers of *Sarracenia purpurea*, namely, chlorophyll, alkaverdin (a purplish-red), and a brownish-black pigment. The solubilities of these substances are described, but their chemical relationships are not yet determined.

W. D. H.

**Action of Sulphur Dioxide, Zinc Oxide, and Zinc Sulphate on Soils and Plants.** EMIL HASELHOFF (*Bied. Centr.*, 1905, 34, 31—33; from *Jahresh. landw. Versuchs-Stat. Marburg*, 1903—1904, 4).—Sulphur dioxide does not injure soils and is rapidly converted into sulphuric acid. Zinc oxide (0.2 per cent.) has a slight effect on the production of wheat when applied alone. In conjunction with lime, there is a greater reduction in the yield. Zinc sulphate in similar

amounts is found to be extremely injurious and its action is not diminished by the application of calcium carbonate. N. H. J. M.

**Proteids of Wheat. I. The Proteid Soluble in Alcohol.** THOMAS B. OSBORNE and ISAAC F. HARRIS (*Amer. J. Physiol.*, 1905, 13, 35—44).—Kutscher's determinations of glutamic acid are considered to afford no evidence that the proteid soluble in alcohol, obtained from the wheat kernel, consists of two distinct proteids. This proteid is probably a single substance; it should be called gliadin, and it is remarkable for the large amount of glutamic acid it yields. The amount is far in excess of that obtained from any other known proteid, and this fact deserves further study in view of the importance of wheat as a food. W. D. H.

**Increase in the Weights of the Organic and Mineral Substances of Oats as a Function of the Age.** MILE. M. STEFANOWSKA (*Compt. rend.*, 1905, 140, 58—60).—It was previously shown (*ibid.*, 1904, 138) that the curve of increase in weight of the fresh substance of several plants is a hyperbola. In the present paper, curves are given for the increase of fresh substance, dry matter, and nitrogen in oats, and calculations have been made for constructing the curves for nitrogen, lime, phosphoric acid, potash, and iron.

Comparing fresh substance, dry substance, and ash, it is seen that the curves have the same general character in the first period of growth. Later on, the fresh substance becomes lower owing to loss of water, but the dry matter continues as before. N. H. J. M.

**Movement of Nitrogenous Compounds and Pentoses in Beet Products during Fabrication.** O. KOPETZKI (*Bied. Centr.*, 1905, 34, 56—65).—Determinations were made of the nitrogen in different forms, the sugar, and furfuroids in the various sugar-beet products. The furfuroids remain for the most part in the extracted sections and the amounts diminish at each stage to the last saturation. N. H. J. M.

**Influence of Soil Moisture on the Amounts of Total and Proteid Nitrogen in Oat Straw.** CONRAD VON SEELHORST and FRESSENIUS (*J. Landw.*, 1905, 53, 27—28).—The results of pot experiments in which the moisture of the soil was 55, 70, and 85 per cent. showed that, as the moisture increases, the proteid nitrogen diminishes less than the total nitrogen, and that the digestible proteid nitrogen diminishes more than the total proteid nitrogen.

In a dry season, the food value of straw will be higher than in a wet season. N. H. J. M.

**Denitrification of Soil. III.** GASPARE AMPOLA (*Gazzetta*, 1904, 34, ii, 301—315. Compare Abstr., 1901, ii, 524; 1904, ii, 139).—The author's results lead to the following conclusions: manuring with nitrates of calcium and sodium gives a better result than without nitrate, whilst with calcium nitrate a larger yield is obtained than with sodium nitrate. Green material gives better results as manure than ripe stable manure, the latter better than fresh stable manure, and this again better than straw. The general con-



clusion, which confirms the results formerly arrived at (*loc. cit.*), is that calcium nitrate, the natural product of nitrification, is a better manure than sodium nitrate; further, the calcium salt offers a greater resistance to the action of denitrifying organisms than the sodium one, and this denitrification depends on the organic substances of the manure.

The author is in agreement with the view expressed by other investigators that the dangers of denitrification in the soil may be wholly or partially obviated by applying the nitrates only when the organic substances have been decomposed, that is, when the denitrifying bacteria have been reduced to inaction. T. H. P.

**Employment of Dyes in Soil Investigation.** B. SJOLLEMA (*J. Landw.*, 1905, 53, 67—69).—The amount of colloids in soils may be approximately estimated by treatment with a solution of methyl-violet (0.1—0.2 gram in 500 c.c.), which dyes the colloids but not the quartz, and examining with a microscope.

Experiments with different dyes and various colloids gave the following results: amorphous silica is coloured by methyl-violet, but not by naphthol-yellow, Congo-red, or alizarin. Aluminium silicate is coloured by methyl-violet and alizarin, not by Congo-red or naphthol-yellow. Alumina is coloured by all four dyes. Kaolin remained almost entirely colourless, only a very small portion of it fixing the different dyes. N. H. J. M.

**Isolation of the Colloid Substances of Soils.** B. SJOLLEMA (*J. Landw.*, 1905, 53, 70—76).—The soil is rubbed in a mortar with water several times, the water being poured off each time, evaporated nearly to dryness on a water-bath, and finally dried in a desiccator. The residue from the water is then centrifugalised in a mixture of bromoform and chloroform of sp. gr. 2.5 for two or three minutes. The liquid is poured off, filtered, and the residue on the filter washed with ether and dried. The whole process is repeated, a mixture of bromoform and chloroform having a lower sp. gr. (about 2.32) being employed. Treatment of the residue with methyl-violet and examination with a microscope (see preceding abstract) will give an idea as to the amount of sand still present.

A sample obtained in the manner described was treated successively with hydrochloric acid of sp. gr. 1.05 for 1 hour at 60°, with boiling 25 per cent. hydrochloric acid for 1 hour, and with sulphuric acid (2 parts to 1 part water) to decompose the kaolin. The undissolved portion consisted chiefly of quartz. The results show that the sample contained about 20 per cent. of kaolin and about 60 per cent. of silicates soluble in hydrochloric acid. Altogether about 95 per cent. of the constituents could be accounted for, and the remaining 5 per cent. consisted partly of phosphoric acid which was not determined.

N. H. J. M.

**Manuring as based on Ten Years' Experiments.** CONRAD VON SEELHORST (*J. Landw.*, 1904, 53, 29—60).—The results of

ten years' experiments on the same land with different cereals, man-gels, potatoes, peas, and beans, are summarised. The large number of results are, however, insufficient to explain the manner in which the different climatic factors influence the crop. In the case of cereals and peas, the results show certain relations between weather and yields, but exceptions occur which cannot be accounted for with certainty.

N. H. J. M.

**Employment of Calcium Cyanamide as Manure.** RENATO PEROTTI (*Chem. Centr.*, 1905, ii, 117; from *Stat. sper. agrar. ital.*, 37, 787—805).—In order to avoid injury to seed, the manure should be applied some time beforehand, according to the character of the soil. The manure is favourable to early ripening.

N. H. J. M.

**Manurial Experiments with Calcium Cyanamide and Garden Plants.** RICHARD OTTO (*Chem. Centr.*, 1905, ii, 117; from *Gartenflora*, 1904).—Calcium cyanamide was found to be equal to nitrates and ammonium salts in the case of spinach, although at first growth was somewhat retarded. Equally satisfactory results were obtained with lettuce when planted twelve days after manuring.

The results of pot experiments showed that calcium cyanamide gave better results with white cabbage and maize than sodium nitrate. The manure seems to be suitable for garden plants provided that it is applied a week or two before planting, or else dug in to a depth of 13—26 cm.

N. H. J. M.

**Injurious Action of Ammonium Thiocyanate [on Seeds and Plants].** EMIL HASELHOFF (*Bied. Centr.*, 1905, 34, 24—25; from *Jahresb. landw. Versuchs-Stat. Marburg*, 1903—1904, 3).—The crude manure, gas phosphate, obtained by purifying coal gas with superphosphate, contains large amounts (14.6 per cent.) of ammonium thiocyanate, most of which can be removed by washing with a concentrated solution of ammonium sulphate. The purified manure, however, still contains some thiocyanate (0.76 per cent.).

The results of germination experiments with red clover and mustard showed that even 0.0025 per cent. of ammonium thiocyanate retards germination, whilst with 0.1 per cent. germination was almost completely checked.

In pot experiments with oats, wheat, and mustard, it was found that 0.1 gram of ammonium thiocyanate (in 8.5 kilos. of soil) reduced the yield to 14.8 per cent., or in presence of calcium carbonate to 33 per cent. With 0.2 gram, there was scarcely any yield, and this amount is injurious even when applied twelve weeks before sowing. The purified substance is therefore useless as manure.

N. H. J. M.

**The Agricultural Value of Humus Matter.** J. DUMONT (*Compt. rend.*, 1905, 140, 256—258. Compare Abstr., 1904, ii, 637).—Comparative experiments on the relative agricultural values of humic manure, mineral phosphates, and ordinary manure show that in the cases of sugar-beet, potatoes, maize, and lucerne a larger yield was obtained with the humic manure than with either of the other two,

the superiority being due to the humo-phosphates, which yield phosphoric acid more readily than do the mineral superphosphates.

M. A. W.

**Action of Crude and Pure Potassium Salts with Calcium in Different Forms.** WILHELM SCHNEIDEWIND and O. RINGLEBEN (*Bied. Centr.*, 1905, **34**, 12—18; from *Landw. Jahrb.*, 1904, **33**, 353. Compare Abstr., 1904, ii, 765 and 769).—Cereals and beet are benefited by the sodium chloride and other salts present in kainite, which should be employed unless the formation of crusts is likely to occur. For potatoes, 40 per cent. potassium salts are preferable. N. H. J. M.

**[Manurial] Action of Different Forms of Calcium and Magnesium.** DIEDRICH MEYER (*Bied. Centr.*, 1905, **34**, 18—24; from *Landw. Jahrb.*, 1904, **33**, 371. Compare Abstr., 1902, ii, 44).—When a soil is deficient in lime, both lime and magnesia are beneficial. When sufficient lime is present and the amounts of magnesia vary, no effect is produced by adding lime or magnesia unless the amounts applied are large. The lime requirements of soils must be judged by the amount of calcium present, except in the very rare cases in which the soil contains large amounts of magnesium.

N. H. J. M.

## Analytical Chemistry.

**Report from Committee on Uniformity in Analysis. I.** [WILLIAM F. HILLEBRAND, CHARLES B. DUDLEY, HENRY N. STOKES, CLIFFORD RICHARDSON] (*J. Amer. Chem. Soc.*, 1904, **26**, 1644—1653).—A statement of the objects of the Committee on Uniformity in Chemical Analysis and of the policy it has adopted for the guidance of its work.

L. DE K.

**Statement of Analytical Results.** WILHELM FRESSENIUS (*Zeit. anal. Chem.*, 1905, **44**, 32—36).—At the 5th International Congress for Applied Chemistry, held at Berlin, the first three of the following proposals were unanimously adopted, the fourth being referred back to the Analytical Committee for further consideration of the expression “ionand.” This expression, suggested by the author, is intended as a substitute for “ion” in cases where ionisation does not occur (for example, in a solid substance).

1. In all cases of statement of analytical results, the name should be followed by the formula.

2. By the name of an acid, the acid itself and neither its anhydride nor its ion is to be understood.

3. When results are calculated in the form of metal oxide and acid anhydride, the latter should be written thus :



Sulphuric acid (—anhydride)  $\text{SO}_3$ , or

Sulphuric acid (calculated as anhydride)  $\text{SO}_3$ .

4. When stated as ions or ionands, the metals should be cited by their names, distinguishing degrees of oxidation thus: mercurio-ion (or ionand), mercuri-ion (or ionand), and the anions or anionands as sulphate-ion (or sulphate-ionand) ( $\text{SO}_4$ ), &c. M. J. S.

**Use of the Micro-balance in Analysis.** O. BRILL (*Ber.*, 1905, 38, 140—146. Compare Nernst and Riesenfeld, *Abstr.*, 1903, ii, 571; Jänecke, this vol., ii, 66).—In order to obtain accurate results with the micro-balance, attention to the following points is necessary. Where cement is used in its construction, celluloid or sealing wax is better than water-glass, which is hygroscopic; to avoid errors due to adhesion or to parallax, the indicator must be 2—3 mm. from the scale; the weights and pans must hang freely on the hooks; the balance must not stand on wood; the swing should extend to 80—100 scale divisions; with a greater swing, the balance is less sensitive. The micro-balance is to be recommended when simple analytical processes have to be accomplished rapidly, when only a small quantity of a substance is available, when a hygroscopic substance is analysed, and when the weighings must be carried out at a certain temperature.

Various estimations are quoted to show that accordant results can be obtained by it, although the quantities employed are only 1—2 mg. G. Y.

**Use of the Rotating Anode in Electro-analysis.** EDGAR F. SMITH [with GEORGE H. WEST and LILY G. KOLLOCK] (*J. Amer. Chem. Soc.*, 1904, 26, 1595—1615).—A number of experiments in which a rotating anode has been successfully employed in the electric precipitation of nickel and cobalt in the presence of various electrolytes such as ammonium acetate, sodium acetate, ammonia and ammonium sulphate, sodium formate, ammonium lactate, sodium lactate, and ammonium succinate. The results are illustrated by curves.

Favourable results are anticipated from the joint use of a rotating anode with a mercury cathode. L. DE K.

**Testing Glass Vessels as to Neutrality.** E. BARONI (*Chem. Centr.*, 1905, i, 43; from *Giorn. Farm. Chim.*, 1904, 53, 481—482).—The vessels are filled respectively with a 1 per cent. solution of morphine hydrochloride, a 0.5 per cent. solution of strychnine hydrochloride, and a 1 per cent. solution of mercuric chloride, and heated for half-an-hour in an autoclave at  $112^\circ$ . If after that time no change has taken place, the glass may be said to yield no alkali to water. If it does so, the morphine solution gives a brown, alkaloidal deposit, the strychnine solution also deposits free alkaloid, whilst the mercury solution deposits yellow, red, or brown oxides. L. DE K.

**Table for the Preparation of Normal Solutions of Hydrochloric Acid according to the Density.** FRIEDRICH W. KÜSTER and SIEGMAR MÜNCH (*Ber.*, 1905, 38, 150—152. Compare *Abstr.*, 1903, ii, 98).—The authors give directions for the determination, to

within  $\pm 0.0001$ , of the sp. gr. of solutions of hydrochloric acid by means of the 100 c.c. pipette and the analytical balance. A table is given, for the dilution to normal, of solutions of hydrochloric acid of sp. gr. 1.0500—1.1400 at 18°.

G. Y.

**The Mechanism of the Guaiacum Reaction.** NEUMANN-WENDER (*Chem. Centr.*, 1905, i, 122; from *Österr. Chem. Zeit.*, 7, 533—536).—The blue coloration is due to the oxidation by active oxygen of guaiaconic acid, with formation of an ozonide. The active oxygen is generated by the decomposition of hydrogen peroxide or an organic peroxide. This may be formed by the auto-oxidation of a component of the resin, or through the agency of an enzyme or enzyme compound (peroxydase, oxygenase).

L. DE K.

**Colorimetric Estimation of Hydrogen Peroxide.** PAUL PLANES (*J. Pharm. Chim.*, 1904, [vi], 20, 538—541).—In acid solution, hydrogen peroxide reacts on potassium iodide, iodine being set free, according to the equation:  $2KI + H_2O_2 + H_2SO_4 = K_2SO_4 + 2H_2O + I_2$ . Therefore, 0.022857 gram of iodine corresponds with 1 c.c. of oxygen, or 1 gram of iodine with 43.75 c.c. of oxygen. The quantity of iodine liberated may be estimated by treating a 10 per cent. solution of the hydrogen peroxide with 12 c.c. of a 10 per cent. solution of potassium iodide and 4 c.c. of an 8 per cent. solution of sulphuric acid, and comparing the coloration produced with that yielded by known quantities of a  $N/10$  solution of iodine.

W. P. S.

**Some Sources of Error in Sulphur Estimations.** JOHN PATTINSON and JOHN T. DUNN (*J. Soc. Chem. Ind.*, 1905, 24, 10—11).—Red india-rubber bungs, such as are used for wash-bottles, sometimes yield up sulphuric acid to water, especially when acted on by boiling water or steam. This sulphuric acid is probably due to the oxidation of the sulphur used for vulcanising or of metallic sulphides which have been added to the india-rubber. The authors have also found appreciable quantities of sulphur compounds in commercial samples of barium chloride.

W. P. S.

**Estimation of Sulphur in Pyrites by Lunge's Method.** (THE LATE) H. SALVIN PATTINSON (*J. Soc. Chem. Ind.*, 1905, 24, 7—10).—In this method, the presence or absence of ammonium chloride, within the limits usually obtaining, has apparently no influence on the retention of chlorides by the barium sulphate or on the character of the precipitate of the latter. The degree of acidity, however, has an important effect. With less than 0.17 c.c. of hydrochloric acid per 100 c.c. of liquid, the precipitate retains barium chloride and is very fine. About 0.3 c.c. of hydrochloric acid per 100 c.c. gives the best results. With regard to the excess of ammonia necessary to be added to precipitate the ferric hydroxide and to prevent the formation of basic ferric sulphate, it is advisable to add an excess of at least 5 c.c. of ammonia of sp. gr. 0.88 at whatever temperature the precipitation and filtration be carried out. The most accurate results are obtained by precipitating the ferric hydroxide at a temperature of 70° and keeping the mixture

at this temperature for 15 minutes before filtering. The presence of ammonium chloride in considerable amount has but little effect on the solubility of barium sulphate.

W. P. S.

**Iodometric Estimation of Sulphurous Acid in Alkaline Solution.** OTTO RUFF and WILLI JEROCH (*Ber.*, 1905, 38, 409—419).—In the estimation of sulphurous acid by addition of sodium hydrogen carbonate and an excess of iodine solution and titration with sodium thiosulphate (Rupp, *Abstr.*, 1903, ii, 40), an error is caused by the partial oxidation of the thiosulphate to sulphate, owing to the presence of sodium hypoiodite (compare Förster and Gyr, *Abstr.*, 1903, ii, 209). The low values obtained on direct titration with iodine are shown to be due to the oxidising action of air, the iodine ions acting as an accelerator. This action may be hindered by taking precautions to prevent the access of air to the solutions, and also by adding a negative catalytic agent, such as mannitol (Bigelow, *Abstr.*, 1898, ii, 506). In the method finally recommended, a measured volume of the sulphite solution, made up with air-free water, is saturated with sodium hydrogen carbonate, 10—20 per cent. of mannitol is added, and the solution is titrated with iodine in an atmosphere of carbon dioxide. The results are independent of the concentration of the sulphite.

C. H. D.

**Analysis of Solutions of Hyposulphites. Analysis of Formalin.** E. I. ORLOFF (*J. Russ. Phys. Chem. Soc.*, 1904, 36, 1311—1317).—The method proposed by the author for the estimation of hyposulphites in solution is based on the fact that when such a solution is mixed with an alkaline solution of mercury potassium iodide, metallic mercury is deposited as a grey powder,  $\text{HgI}_2 \cdot 2\text{KI} + \text{Na}_2\text{S}_2\text{O}_4 + 4\text{NaOH} = \text{Hg} + 2\text{NaI} + 2\text{KI} + 2\text{Na}_2\text{SO}_3 + 2\text{H}_2\text{O}$ . The mercury deposited is filtered by means of an asbestos filter and well washed with water on the filter. The plug of asbestos, together with the mercury, is then placed in a solution of sodium hydroxide, which is subsequently mixed with a known volume of *N*/10 iodine solution. After the mercury has dissolved, the solution is acidified with hydrochloric acid and the excess of iodine which has not combined with the mercury is estimated by titration with *N*/10 sodium thiosulphate solution. From the quantity of iodine taken up by the mercury, the amount of hyposulphite can be calculated, since  $2\text{I}:\text{Hg}:\text{Na}_2\text{S}_2\text{O}_4$ ; every c.c. of *N*/10 iodine corresponds with 0.0087 gram  $\text{Na}_2\text{S}_2\text{O}_4$ .

When a dilute solution of formaldehyde is mixed with an alkaline solution of mercury and potassium iodide, metallic mercury is deposited as an amorphous, grey powder, the reaction being  $\text{HgI}_2 \cdot 2\text{KI} + 3\text{KOH} + \text{H} \cdot \text{CHO} = \text{Hg} + 2\text{KI} + \text{H} \cdot \text{CO}_2\text{K} + 2\text{H}_2\text{O}$ . The mercury is filtered on to an asbestos filter and its amount estimated in the manner just described. Each c.c. of *N*/10 iodine solution combining with the mercury corresponds with 0.0015 gram of formaldehyde.

The solid "hyposulphite NF," put on the market about two years ago, consists of a mixture of the two compounds,  $\text{CH}_2(\text{SO}_2\text{Na})_2$  and  $\text{Na}_2\text{SO}_3 \cdot \text{ZnSO}_3$ . The first of these two compounds possesses the same reducing properties as sodium hyposulphite and its quantity may be estimated by the mercury method described above. The reaction in



this case is represented by the equation  $\text{CH}_3(\text{SO}_2\text{Na})_2 + 3\text{HgI}_2 + 9\text{KOH} = 3\text{Hg} + \text{H}\cdot\text{CO}_2\text{K} + 2\text{NaKSO}_3 + 6\text{KI} + 5\text{H}_2\text{O}$ . T. H. P.

**Frerich's Estimation of Tellurium.** ALEXANDER GUTBIER and W. WAGENKNECHT (*J. pr. Chem.*, 1905, [ii], 71, 54—56. Compare Abstr., 1902, ii, 134, 254, 558, 653; 1903, ii, 100; Frerich, Abstr., 1903, ii, 41).—The reduction of the oxides of tellurium by means of sulphur dioxide in presence of potassium iodide cannot be used as a means of estimating tellurium, as a varying proportion of tellurium tetraiodide is always formed. G. Y.

**Detection of Nitrogen in Organic Substances.** V. CASTELLANA (*Gazzetta*, 1904, 34, ii, 357—360).—The substance to be tested is intimately mixed with sodium or potassium carbonate and powdered magnesium, and the mixture heated in a test tube or porcelain crucible or on platinum foil. The mass is tested for cyanide in the ordinary way. If the substance is a liquid, a few drops of it may be allowed to fall on to the mixture of carbonate and magnesium when these two substances are reacting vigorously. T. H. P.

**Influence of Various Kinds of Glass on the Accuracy of Kjeldahl's Nitrogen Process.** HANS SCHÖNEWALD and K. BARTLETT (*Chem. Centr.*, 1905, i, 47; from *Woch. Brauerei*, 21, 793—794).—Experiments showing that the only trustworthy condensers are those made of Jena glass, which yield practically no alkali to the distillate. L. DE K.

**Analysis of Compounds containing Nitrogen in Union with Nitrogen by means of Kjeldahl's Method.** CL. FLAMAND and BERNHARDT PRAGER (*Ber.*, 1905, 38, 559—560. Compare Dafert, Abstr., 1888, 85; Krüger, Abstr., 1894, ii, 258, 397).—Kjeldahl's method is applicable to azo-, azoxy-, and hydrazo-compounds which have been subjected to the following preliminary treatment.

0.15—0.2 gram of the substance to be analysed is mixed with 10 c.c. of alcohol, 0.5—1 gram of zinc dust, and 2—5 c.c. of concentrated hydrochloric acid of sp. gr. 1.19, and heated until decolorisation takes place. Ten c.c. of concentrated sulphuric acid and 0.5 gram of crystalline copper sulphate are then added and the mixture heated until white fumes are evolved. After addition of 6 grams of powdered potassium sulphate, the liquid is heated until it becomes clear and light green.

This method does not give accurate results with phenylhydrazine, benzylidenephénylhydrazine, and formazyl compounds. G. Y.

**Estimation of Nitrogen in Barley.** E. GLIMM (*Chem. Centr.*, 1905, i, 46; from *Woch. Brauerei*, 21, 723—724).—1.5—1.8 grams of whole barley are introduced into a large Kjeldahl flask, 1 drop of mercury is added, and then 18—20 c.c. of sulphuric acid, which is allowed to moisten the sides of the neck and the flask. Fifteen to twenty grams of potassium sulphate are added in such a manner that a considerable portion will adhere to the neck. The whole is then heated

in the usual manner for about an hour. The frothing which takes place at first is harmless, as the crystals of potassium sulphate which are constantly dropping down break up the lather. The ammonia formed is estimated as usual.

L. DE K.

**Estimation of Nitrogen in Barley.** NEUMANN (*Chem. Centr.*, 1905, i, 46; from *Woch. Brauerei*, 21, 724—725).—A criticism of Glimm's process (see preceding abstract). The boiling should be continued for at least 10—15 minutes after the mixture has become colourless. The author also thinks that the quantity of barley operated on cannot always represent a fair sample.

L. DE K.

**Simplified Elementary Analysis. A Quick Method.** MAXIMILIANO DENNSTEDT (*Chem. Zeit.*, 1905, 29, 52—54. Compare *Abstr.*, 1903, ii, 103).—Details are given of a quick method for performing combustions in a rapid current of oxygen with the apparatus previously described.

A. McK.

**Elementary Analysis by Dennstedt's Method.** HUGO WEIL (*Ber.*, 1905, 38, 282—283).—A case is recorded in which the "active" platinum used in Dennstedt's method of combustion (*Abstr.*, 1897, ii, 432; 1898, ii, 146) had its activity destroyed by the presence of tin in the substance analysed.

W. A. D.

**Estimation of "Coke" and "Volatile Matter" in Coal.** GEORGES ARTH (*Bull. Soc. Chim.*, 1905, [iii], 33, 127—129).—The author employs for this purpose a platinum crucible with a capsular lid from 5—6 mm. deep, carrying on its upper surface a platinum tube 4—5 mm. in diameter and 15 mm. long, which can be closed at its upper extremity by a platinum cap. The crucible is heated by a flame 28—30 cm. high, produced by a blowpipe worked by a pump, and is placed at a height of 10 cm. above the aperture of the blowpipe. At the commencement of the operation, the cap is placed on the tube, but as soon as a bright flame appears at the mouth of the tube the cap is removed and is replaced when the flame begins to die down. The heating is continued for about 1 minute after the flame has disappeared. The results obtained in this way are more uniform than those given by Muck's method and the "coke" more nearly approaches in composition that obtained on the large scale (compare Constam and Rougeot, *Zeit. angew. Chem.*, 1904, 17, 737).

T. A. H.

**Estimation of Organic Carbon in Soils.** J. H. PETTIT and T. O. SCHAUB (*J. Amer. Chem. Soc.*, 1904, 26, 1640—1642).—Two grams of the soil are mixed with 1 gram of magnesium powder and 10 grams of sodium peroxide and ignited in a Parr bomb. The residue then contains all the carbon as carbonate and the carbon dioxide is estimated as usual in a Hempel apparatus. As part of the magnesium is left in the metallic state, the gas evolved on acidifying will contain an admixture of hydrogen. Allowance is, of course, made for the presence of carbonates in the soils and reagents.

L. DE K.

**Apparatus for the Estimation of Carbon in Iron by Eggertz's Method.** HANS SCHUMACHER (*Chem. Zeit.*, 1905, 29, 35).—The apparatus (Fig. 1) consists of a doubly-graduated cylinder divided vertically by means of an opaline glass wall into two compartments of 20 c.c. capacity. The funnel-shaped spouts *a* and *b* admit the two liquids to be compared. The solution of the sample is introduced into *a*, which during the shaking is closed with the finger, whilst *b* contains the standard liquid and is closed with a cork. When using this apparatus, the difference in shade of colour is more easily noticed than with the ordinary apparatus used for this purpose.

Fig. 2 represents a similar arrangement suitable in case of a large number of analyses. The tube *a*, which contains the comparison liquid, has a flat opaline wall. The other tubes (*b*), which are made of plain glass, are filled with the liquids to be tested and then placed alongside *a*.

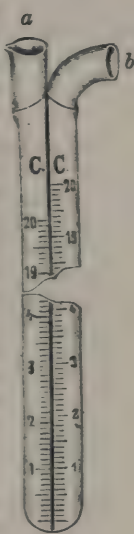


FIG. 1.

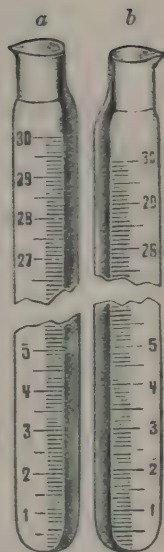


FIG. 2.

L. DE K.

**Estimation of Carbon Monoxide in Confined Atmospheres.** ALBERT LÉVY and A. PÉCOUL (*Compt. rend.*, 1905, i, 98—99).—The authors have devised a portable apparatus for estimating directly the carbon monoxide in the atmosphere of confined spaces; the method employed is due to Gautier and consists in collecting in chloroform the iodine liberated from iodine pentoxide by the reducing action of the carbon monoxide at 80°, and comparing the colour of the solution with those of a series of standard tubes containing solutions of iodine of known strengths. The reaction is sufficiently delicate to admit of the estimating of  $\frac{1}{200000}$  of its volume of carbon monoxide in four litres of air.

M. A. W.

**Indirect Estimation of Carbon Dioxide in Salts.** O. LUTZ and A. TCHISCHIKOFF (*J. Russ. Phys. Chem. Soc.*, 1904, 36, 1274—1281).—In the indirect estimation of carbon dioxide in salts by determining the loss of weight on fusion with potassium dichromate, &c., the authors recommend the use of sodium metaphosphate. This substance fuses at a low temperature, yields a thin liquid, and only requires about 20 minutes' fusion to expel all the carbon dioxide. The nitrogen pentoxide in nitrates may also be similarly determined by fusion with sodium metaphosphate. This method cannot be employed (1) when the base combined with the carbon dioxide is readily transformed, during the melting, into a higher state of oxidation by absorbing oxygen from the air (in some cases it may, however,



be used if the fusion is carried out in a stream of an indifferent gas), or (2) when the substance to be analysed contains other compounds volatile under the conditions of the experiment, such as the chlorides of the alkali metals; it may be used in such cases, however, to obtain the total volatile matter.

T. H. P.

**Estimation of Potassium.** FRIEDRICH KLINKERFUES (*Chem. Zeit.*, 1905, 29, 77—78).—Without troubling about the presence of sulphates or phosphates, a sufficiency of the solution is evaporated to dryness with addition of platinic chloride. The residue is slightly moistened with water and the excess of platinic chloride removed by repeated extraction with alcohol. The residue is then dissolved in boiling water and the filtered solution evaporated to dryness in a platinum dish with addition of a little formic acid. The reduced platinum adheres so firmly to the sides of the dish that it may be washed without the least loss with boiling water; in some cases, a further washing with 5 per cent. nitric acid is advisable. After gentle ignition, the crucible is cooled in a vacuum-desiccator and weighed and the weight calculated, say, to potassium oxide.

L. DE K.

**Estimation of Potassium in Soils, Plants, and Fertilisers.** FLETCHER P. VEITCH (*J. Amer. Chem. Soc.*, 1905, 27, 56—61).—Attention is called to the apparently forgotten, though excellent, process proposed by Moore, the main feature of which is the removal of any iron or aluminium chlorides by means of acidified alcohol (*Abstr.*, 1898, ii, 539).

L. DE K.

**Separation of Silver from Lead.** HJ. LIDHOLM (*Ber.*, 1905, 38, 566—568).—The mixture containing lead and silver is dissolved, the filtered solution neutralised, and sodium acetate added. If a precipitate of basic lead acetate is formed, it is dissolved by the addition of acetic acid and the solution boiled. On addition of a solution of quinol, the silver is immediately and quantitatively precipitated.

The presence of cadmium does not affect the separation. Copper, however, is partially reduced and partially precipitated as phenoxide. Bismuth is partially reduced. A modification of the method in those cases where copper or bismuth is present is described.

A. McK.

**Estimation of Calcium and Magnesium Carbonates.** CARLO MONTANARI (*Chem. Centr.*, 1905, i, 48; *Staz. sperim. agrar. ital.*, 37, 810—814).—The estimation of calcium and magnesium carbonates in soils by heating with solution of ammonium nitrate (Frühling's process) is untrustworthy, as not only calcium sulphate but also calcium phosphate and calcium ortho- and di-silicates are more or less attacked.

L. DE K.

**Technical Analysis of Cements.** STEPHEN F. PECKHAM (*J. Amer. Chem. Soc.*, 1904, 26, 1636—1640).—Largely polemical in reference to papers by Hillebrand (*ibid.*, 25, 1180) and Blount (*Abstr.*, 1904, ii, 681).

L. DE K.

**Detection of Small Quantities of Barium and Strontium.** L. BLUM (*Zeit. anal. Chem.*, 1905, 44, 9—10).—In consequence of the tendency of ammonium sulphide to oxidation, barium and strontium may be entirely precipitated as sulphates together with the

sulphides of groups III and IV. It is therefore advisable to employ freshly prepared ammonium sulphide and to examine the nickel and cobalt sulphides for the alkaline earths.

M. J. S.

**Accuracy of the Dry Assay of Galena in an Iron Crucible.** WILLIAM F. LOWE (*J. Soc. Chem. Ind.*, 1905, 24, 6—7).—The dry assay of galena is much more accurate than is generally supposed and for rich ores will give very good results. It is not suitable for poor ores, and for such a wet method should be used, but it can be used for most samples of dressed ore. Worked as follows, the method is stated to give results differing by only about 0.03 per cent. from the amount of lead actually present in the ore: 32.666 grams of ore (1 assay ton), 3 grams of potassium hydrogen tartrate, and 30 grams of sodium carbonate are mixed and placed in the front part of a bright copper scoop, 10 grams of crystallised borax being placed in the scoop behind the mixture. The whole charge is then shot into a red-hot wrought-iron crucible and placed in the furnace until the charge has run down and the surface is clear. The crucible is now shaken and its contents poured into a conical iron mould. Any particles of lead remaining in the crucible are collected by tapping it, run into another mould, and weighed with the large button. As soon as the flux has solidified, the button is separated, hammered, washed, dried, and weighed. The chief precaution is to remove the crucible from the furnace as soon as the reduction has taken place, usually in about 10 minutes; the temperature, also, must not be too high.

W. P. S.

**Aluminium as a Preventive of Acute and Chronic Mercury Poisoning.** NAZARENO TARUGI (*Gazzetta*, 1904, 34, ii, 486—492).—Contrary to the generally accepted opinion, the efflorescence of aluminium amalgam does not require the presence of water, as it is produced when the amalgam is formed from mercury vapour and aluminium in dry air. The appearance of this efflorescence may be used as a means for detecting very minute quantities of mercury. On heating a mixture of a small quantity of a mercury salt with calcium oxide in a tube, to the open end of which is applied a thin sheet of aluminium, the latter becomes immediately coated with the amalgam. When a spiral of fairly stout aluminium wire is immersed for about ten minutes in a boiling dilute solution of mercuric chloride rendered slightly acid with sulphuric acid and is subsequently removed from the liquid, well dried by means of filter paper, and exposed to the air, in a few minutes the part which was immersed exhibits the fluorescence characteristic of aluminium amalgam. In this way, one-ten-millionth part of a milligram of mercury may be rendered apparent. No other metal exhibits such great capacity for fixing vapours of mercury or mercury compounds.

The author has constructed and patented a mask of fine aluminium gauze for the use of persons working in an atmosphere containing mercury vapour. Even though the air is saturated with mercury vapour, the latter is all absorbed by the aluminium and no symptoms of mercurial poisoning ensue.

T. H. P.

**Use of Tannic Acid in the Estimation of Alumina.** ROBERT E. DIVINE (*J. Soc. Chem. Ind.*, 1905, 24, 11).—If to a solution containing approximately 0.1 gram of alumina 2 c.c. of a 2.5 per

cent. solution of tannic acid are added, then ammonia in slight excess, and the solution boiled until the odour has almost disappeared, the aluminium hydroxide is precipitated in a form which filters readily. This precipitate is also easily washed free from chlorides. The presence of tannic acid does not interfere with the subsequent separation of calcium and magnesium in the filtrate from the aluminium hydroxide should these be present, as in the analysis of clays, &c. Pure ferric hydroxide does not, however, filter satisfactorily in the presence of tannic acid.

W. P. S.

**Estimation of Manganese as Green Sulphide.** JOHN C. OLSEN, E. S. CLOWES, and WILLIAM O. WEIDMANN (*J. Amer. Chem. Soc.*, 1904, **26**, 1622—1627. Compare Abstr., 1903, ii, 372).—Ten c.c. of the solution supposed to contain about 0.15 gram of manganese are poured into 90 c.c. of boiling water containing 2.75 grams of ammonium chloride and five times the theoretical amount of ammonium sulphide, which should be free from polysulphide. After further heating for half-an-hour, the precipitation is complete, the green manganous sulphide is collected, washed with dilute ammonium sulphide, and dried. It is then converted into anhydrous sulphide by ignition with sulphur in a current of hydrogen, as usual.

L. DE K.

**Estimation of Manganese as Sulphide in Ores containing Barium.** L. BLUM (*Zeit. anal. Chem.*, 1905, **44**, 7—9).—In consequence of the liability of ammonium sulphide to oxidation, the manganese sulphide is always contaminated with barium sulphate and thiosulphate unless the barium has first been removed by adding a little sulphuric acid whilst separating iron and alumina as basic acetates. The same source of error exists in the separation of manganese and iron by the barium carbonate method.

M. J. S.

**Detection of Ferrous Oxide in Presence of Ferric Oxide.** L. BLUM (*Zeit. anal. Chem.*, 1905, **44**, 10—11).—The formation of the brown compound of nitric oxide and ferrous salts can be utilised in cases where the ferricyanide reaction is obscured by the presence of other metals. The solution to be tested is mixed with an equal volume of concentrated sulphuric acid, the mixture cooled, and a large fragment of potassium nitrate thrown in. The crystal becomes surrounded with characteristic reddish-brown streaks. If much chloride is present, this should be mainly converted into sulphate by boiling the mixture after adding the sulphuric acid.

M. J. S.

**Estimation of Iron in Blood by the Ferrometer.** ADOLF JOLLES (*Zeit. anal. Chem.*, 1905, **44**, 6—7).—A series of estimations of iron in blood, in which the results obtained by a volumetric process from 20 c.c. of blood were compared with those yielded by the author's "ferrometric" method (this vol., ii, 67), showed only insignificant differences. The necessity for employing the mean of several readings is insisted on.

M. J. S.

**Electrolytic Deposition of the more Important Metals from Moving Solutions.** ARTHUR FISCHER and R. J. BODDAERT (*Zeit. Elektrochem.*, 1904, **10**, 945—953).—The ordinary electrolytic methods of estimation of several metals are compared experimentally with the



methods using rapidly rotating electrodes, in order to discover how far the estimation can be shortened without sacrifice of accuracy. Except where otherwise noted, a matt platinum dish was used as cathode and a disc of platinum making up to 800 revolutions per minute as anode. The best conditions observed are as follows :

*Nickel*.—Cold saturated solution of ammonium oxalate, 6—7 volts, 8 amperes. Time for complete precipitation, 40 minutes, temperature 20—60°.

*Zinc*.—Good results are obtained with a solution containing sodium acetate and acetic acid, but the most satisfactory deposit was obtained from a strongly alkaline solution containing a little potassium cyanide. Five amperes and 5 to 5.4 volts were used, temperature 95°, time required 20 minutes.

*Copper*.—Good results are obtained with any of the usual solutions ; with a current of 5 amperes and working at 95°, the precipitation is complete in from 10 to 30 minutes according to the quantity of metal present. It is advisable to add ammonia when most of the copper is deposited and stop the current when the blue colour has disappeared.

*Bismuth*.—The metal is always deposited in a spongy condition, and trustworthy results cannot be obtained.

*Cadmium*.—Fairly good results were obtained by using a solution acidified with sulphuric acid ; with 5 amperes, 15—16 volts, and a temperature of 95°, the metal is deposited in 10—15 minutes, only the last part of it being spongy.

*Lead*.—The deposition of lead at the anode in the form of the peroxide is complete in 15 minutes at 95°, using 10 amperes and 3.5 volts. The precipitation is perfect.

*Silver*.—This metal is deposited from the solution in potassium cyanide with a current of 2 amperes and 4.5 volts at 95° in 10 to 15 minutes. The results are about 0.2 per cent. low.

*Mercury* is deposited from a solution in nitric acid ; the temperature must not be allowed to rise above 45°, otherwise mercury is volatilised. Using 4 amperes and 5.4—6 volts, the deposition is complete in 15 to 20 minutes.

*Antimony*.—The metal was used in the form of thioantimonate, polysulphides being removed by adding potassium cyanide. The results were, however, always low, especially with quinquevalent metal, probably owing to some of the antimony going to the anode in the form of a complex anion.

*Tin*.—The results were similar to those obtained with antimony, probably for the same reason.

In conclusion, the construction of a stand which permits the anode to be rotated and which has suitable electrical connections is described.

T. E.

**Electrolytic Analysis of Cobalt and Nickel.** F. MOLLWO PERKIN and W. C. PREBBLE (*Trans. Faraday Soc.*, 1905, 1, 103—109).—Cobalt is quantitatively separated as a bright metallic deposit by electrolysing a solution containing alkali phosphate and a small quantity of phosphoric acid, temperature 55—60°, current density

0.2—1.2 amperes, 2—4 volts. The addition of phosphoric acid is necessary to prevent the separation of alkali cobalt phosphate, but if present in too large quantity it retards very greatly the separation of the cobalt. Addition of hydroxylamine removes any deposited cobalt oxide from the anode during the early stages of the electrolysis. The cobalt deposits from solutions containing ammonium tartrate and oxalate were invariably too heavy; solutions containing ammonia and ammonium borate gave good results, but the deposit was brown.

The acid phosphate solutions were found unsatisfactory in the separation of nickel; excellent results were, however, obtained from solutions containing ammonia and ammonium borate. H. M. D.

**Electrolysis of Cobalt and Nickel Tartrates.** JAY E. ROOT (*J. Physical Chem.*, 1905, 9, 1—12).—The decomposition voltage for cobalt in alkaline tartrate solution is about 1.75 volts, that for nickel about 2.8 volts. It seems possible, therefore, that a quantitative separation would be possible electrolytically. It was found, however, that although, if the voltage be kept below 2.1 volts, the cobalt is deposited in a pure state, yet at higher voltages the cobalt deposited always contains nickel. At these lower voltages, complete separation is possible, but it is exceedingly slow, partly owing to the oxidation of cobaltous salts, and the addition of various reducing agents was not found to make the process satisfactory. It was found that cobalt alone in solution could be accurately determined by electrolysis. In one experiment, it was found that with 0.0870 gram metallic cobalt in solution 0.0802 gram was deposited on the cathode and 0.0122 gram of cobaltic oxide at the anode, the solution being free from cobalt. This weight of oxide corresponds very closely with the formula  $\text{Co}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ , and confirms Coehn's results (*Abstr.*, 1903, ii, 80). L. M. J.

**Combined Oxidimetric Method for the Estimation of Molybdenum Trioxide and Vanadium Pentoxide in Presence of One Another.** BORIS GLASMANN (*Ber.*, 1905, 38, 600—603).—The separation described is based on the fact that vanadic acid in sulphuric acid solution is quantitatively reduced by zinc to vanadium dioxide, and by magnesium to vanadium trioxide, whilst molybdic acid in sulphuric acid solution is reduced by zinc or magnesium to molybdenum sesquioxide. The amounts of vanadic acid and molybdic acid in a mixture may be estimated by titrating the reduction product with potassium permanganate, when the changes involved are represented by the equations: (1)  $5\text{V}_2\text{O}_5 + 5\text{Mo}_2\text{O}_3 + 15\text{O}_2 (= 12\text{KMnO}_4) = 5\text{V}_2\text{O}_3 + 10\text{MoO}_3$  and (2)  $5\text{V}_2\text{O}_3 + 5\text{Mo}_2\text{O}_3 + 25\text{O}_2 (= 10\text{KMnO}_4) = 5\text{V}_2\text{O}_5 + 10\text{MoO}_3$ .

Equal volumes of a titrated solution of both acids were introduced into separate flasks, and the reduction conducted in one case with zinc and hydrochloric acid, and in the other with magnesium and hydrochloric acid. The resulting solutions were then separately mixed with a solution of manganese sulphate, and each solution titrated with standard permanganate. A. McK.

**New Iodometric Estimation of Alkali Heptamolybdates.** BORIS GLASMANN (*Ber.*, 1905, 38, 193—194).—A warm aqueous solution of an alkali heptamolybdate readily precipitates iodine from the usual iodide-iodate mixture (*Abstr.*, 1904, ii, 214) owing to its hydrolysis into normal alkali molybdate and free molybdic acid, as represented by the equation  $3(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} + 12\text{H}_2\text{O} = 9(\text{NH}_4)_2\text{MoO}_4 + 12\text{H}_2\text{MoO}_4$ . The free molybdic acid reacts with the iodide-iodate mixture according to the equation  $20\text{KI} + 4\text{KIO}_3 + 12\text{H}_2\text{MoO}_4 = 12\text{K}_2\text{MoO}_4 + 12\text{I}_2 + 12\text{H}_2\text{O}$ . One gram of the crystallised ammonium heptamolybdate is thus equivalent to 0.822 gram of iodine. J. J. S.

**Detection of Stannous Tin.** L. BLUM (*Zeit. anal. Chem.*, 1905, 44, 11—12).—In the absence of other reducing agents, stannous compounds can be detected by causing them to reduce ferric chloride and then proving the presence of ferrous iron by adding sulphuric acid and potassium nitrate (see this vol., ii, 206). A precipitate containing arsenic, antimony, and tin as sulphides may be examined for tin by boiling it with fuming hydrochloric acid until hydrogen sulphide is completely expelled, and then applying the test to the solution.

M. J. S.

**Estimation of Methyl Alcohol in Formaldehyde.** ROBERT GNEHM and FELIX KAUFLEDER (*Zeit. angew. Chem.*, 1905, 18, 93).—The authors' process (*Abstr.*, 1904, ii, 520) having been adversely criticised by Bamberger, it is now stated that by raising the quantity of crystallised sodium sulphanilate from 90 to 110 grams, the process may also be used for very concentrated solutions of formaldehyde.

L. DE K.

**Colour Reactions for Alcohols (excepting Methyl and Ethyl) and for Compounds of Alcoholic Function or Hydroxylic Compounds.** GABRIEL GUÉRIN (*J. Pharm. Chim.*, 1905, [vi], 14—17).—The colorations are produced by mixing 1 c.c. of the alcohol with 5 or 6 drops of a saturated aqueous solution of furfuraldehyde, and then adding the same amount of concentrated sulphuric acid. With solids, a solution in ethyl alcohol may be used, or the substance may be first dissolved in the acid. A considerable number of mono- and poly-hydric alcohols and phenols, sugars, and hydroxy-acids were examined and the colours obtained are described, the latter being for the most part violet and red or brownish-violet. With cholesterol and anthesterol, the reaction (blue) is characteristic, being produced by a trace of substance in alcoholic solution. G. D. L.

**Estimation of Phenol.** S. J. LLOYD (*J. Amer. Chem. Soc.*, 1905, 27, 16—24).—A modification of Koppeschaar's bromine process, so as to avoid several sources of error. The phenol solution is put into a stoppered flask, and a volume of hydrochloric acid is added equal to about one-fourth of the bulk of the liquid after adding the bromine solution. The bromine solution (9 c.c. bromine, 28 grams potassium hydroxide, water up to 2 litres) is added from a burette until the liquid turns yellow, when another tenth or fifth part of that already used is added. Excess of solution of potassium iodide



(17 grams in 100 c.c.) is added, the liquid is diluted with water (10 c.c. for each c.c. of acid added), and after adding 10 c.c. of chloroform the liberated iodine is titrated as usual, using *N*/50 sodium thiosulphate and starch as final indicator. The bromine solution is checked as usual with the thiosulphate, and from the difference in the two titrations the amount of phenol is calculated.

L. DE K.

**Presence of Dextrose in Tannin Solutions.** H. NOVÉ (*Chem. Centr.*, 1904, ii, 1765; from *Bull. Assoc. Chim. Sucr. Dist.*, 22, 325—326).—Even a concentrated alcoholic solution of tannin gradually undergoes a kind of fermentation with formation of dextrose, and is therefore not to be recommended in sugar analysis.

L. DE K.

**Potassium Oxalate as a Lead Precipitant in Sugar Analysis.** HARRIS E. SAWYER (*J. Amer. Chem. Soc.*, 1904, 26, 1631—1635).—Potassium oxalate is recommended for the removal of the excess of lead added for the purpose of classifying sugar solutions intended for polarimetric or chemical tests.

L. DE K.

**Direct Estimation of Sugar in Beet by Pellet's Water Process: Influence of Air on the Results.** HENRI PELLET and L. PELLETT (*Chem. Centr.*, 1904, ii, 1765; from *Bull. Assoc. Chim. Sucr. Dist.*, 22, 312—317).—A reply to Loga, who states that Pellett's process yields too high results unless care is taken to work in a vacuum. The authors find that the quantity of air left in the mass is too small to affect the results, particularly if care is taken to remove any froth by adding a few drops of ether and alcohol.

L. DE K.

**Estimation of Methylpentosan in Presence of Pentosans.** W. B. ELLETT and BERNHARD TOLLENS (*J. Landw.*, 1905, 53, 13—25).—Rhamnose can be determined by the method employed for pentosans. The aniline acetate test, is, however, unsuitable for methylfurfuraldehyde. A few drops of the distillate produce a yellowish-red coloration when a drop of phloroglucinol solution (in hydrochloric acid of sp. gr. 1.06) is added if methylfurfuraldehyde is present. With small amounts of rhamnose (to 0.15 gram), the distillation may be stopped after 300 or 350 c.c. have been distilled; with larger amounts, the distillate should amount to 400 c.c. or more.

The amount of rhamnose is calculated from the weight of phloroglucide (Pg) as follows:

$$\text{Rhamnose} = \text{Pg}, 1.65 - \text{Pg}^2, 1.84 + 0.010.$$

When pentosans and methylpentosans occur together, the dried mixture of phloroglucides is weighed and extracted in the Gooch crucible for 10 minutes with 15—20 c.c. of alcohol of 95° Tr. at about 60°. It is again dried and weighed. The second weight is that of the furfuraldehyde-phloroglucide, and the difference between the two weights the methylfurfuraldehyde-phloroglucide.

Results of actual determinations with mixtures of rhamnose and arabinose were not entirely satisfactory. They were, however, more

correct than would be the case if the whole of the phloroglucide were calculated as arabinose (or pentose).

Determinations of pentosans and of methylpentosan (as rhamnose) were made with a variety of substances. N. H. J. M.

**Commercial Analysis of Formaldehyde.** WILHELM FRESSENIUS and LEO GRÜNHUT (*Zeit. anal. Chem.*, 1905, 44, 13—24).—Of the numerous methods which have been proposed for the estimation of formaldehyde, four are in practical use, namely, Legler's ammonia and sodium hydroxide methods (Abstr., 1883, 1035), Blank and Finkenbeiner's hydrogen peroxide method (Abstr., 1899, ii, 188), and Romijn's iodimetric method (Abstr., 1897, ii, 166). The ammonia method is known to give results about 1—1·5 per cent. too low (compare Abstr., 1904, ii, 98, 299). The sodium hydroxide process is open to the objection that polymerisation of the aldehyde frequently occurs and impairs the accuracy of the results. The other two methods are free from inherent sources of error, but require certain modifications of the original form to ensure accuracy. In both methods, it is essential that the contact of the formaldehyde with sodium hydroxide should be as brief as possible before the addition of the oxidising reagent, since otherwise formic acid would result from the direct action of the alkali. It is even advisable (in Blank's method) to add a little hydrogen peroxide (5 c.c.) to the soda before bringing it in contact with the formalin, but the time prescribed for adding the whole quantity (50 c.c. in the course of 3 minutes) must not be shortened, nor must the mixture be cooled during the reaction. In Romijn's process, it is advisable to work on much larger quantities than originally prescribed, and in consequence of the smallness of the volume operated on (5 c.c.) it is absolutely necessary that the measurements should be made with great accuracy. The absence of iodate from the iodide and of nitrites from the sodium hydroxide must be ensured, and since the formalin may contain various impurities capable of absorbing iodine, no result should be accepted without the concordance of two distinct methods. M. J. S.

**Quantitative Analysis of some New Surgical Dressings.** WILHELM FRESSENIUS and LEO GRÜNHUT (*Zeit. anal. Chem.*, 1905, 44, 25—31).—*Vioform and Vioform Gauze*.—Chloriodohydroxyquinoline,  $C_9H_6Cl_2O$ , introduced into commerce as a substitute for iodoform, is a light powder readily soluble in cold alcoholic potash. The solution may be boiled for several hours without material alteration. It remains clear when considerably diluted with water, and the vioform is reprecipitated quantitatively when the alkali is exactly neutralised with nitric acid. The gauze may therefore be analysed by soaking 6—8 grams of it with  $N/2$  alcoholic potash for 2 hours in a Soxhlet extractor, washing out with boiling alcohol, diluting the solution with 10 vols. of water, neutralising with nitric acid, collecting the precipitate, washing, and weighing. An estimation of the halogens should be made to confirm the identity of the weighed precipitate.

*Ektogan*.—This substance consists essentially of zinc dioxide with some zinc oxide and carbonate. It dissolves without evolution of

oxygen in dilute mineral acids, and the amount of peroxide either in the substance itself or in gauze prepared with it may be estimated gasometrically by treating the solution (in sulphuric acid) with potassium permanganate and measuring the oxygen evolved.

M. J. S.

**Estimation of the Volatile Acids in Wine.** KARL WINDISCH and THEODOR ROETTGEN (*Zeit. Nahr. Genussm.*, 1905, 9, 70—81).—The total acidity is estimated on 25 c.c. of the wine; 25 c.c. of the wine are then evaporated in a china basin to a volume of 2—3 c.c.; 25 c.c. of hot water are added, and again evaporated down to 3 c.c.; 25 c.c. of water are again added, and a third time evaporated. The residue is then dissolved in hot water and the solution titrated. The result, calculated into tartaric acid, is the non-volatile acidity. The difference between this and the total acidity, multiplied by 0.8, gives the volatile acidity expressed as acetic acid.

As in many wines lactic acid is often the principal acid present, the direct estimation of the volatile acids by distillation is rendered unsatisfactory owing to the partial volatility of the lactic acid. On distilling 50 c.c. of wine with steam, an acid distillate is still obtained after 200 c.c. of distillate have been collected. Carbon dioxide in the steam also introduces an error in the direct estimation, as does the tendency of lactic acid to form a neutral anhydride when subjected to heat.

W. P. S.

**The Mean Molecular Weight of the Non-volatile Fatty Acids of Dutch Butter.** A. OLIG and J. TILLMANS (*Zeit. Nahr. Genussm.*, 1904, 8, 728—730).—The authors find that the molecular weight of the non-volatile fatty acids of Dutch butter frequently exceeds 261 in summer, and is almost always higher than this figure in the autumn. Values were obtained in the months of August, September, and October varying from 257.8 to 271.6, the butters examined being prepared from the milk by the authors themselves. The molecular weight of the non-volatile fatty acids affords, therefore, little evidence of the presence of foreign fats in butter.

W. P. S.

**Colour Reaction of Uric Acid with Phosphotungstic Acid; Preliminary Treatment of Urine before Estimating Urea.** HENRI MOREIGNE (*Ann. Chim. anal.*, 1905, 1, 15).—A claim for priority, and also a reply to Frabot (*Abstr.*, 1904, ii, 844). The author still thinks that phosphotungstic acid is the best precipitant for uric acid in urines although the precipitation is not quite complete.

L. DE K.

**Acidimetry of Animal Liquids.** HANS FRIEDENTHAL (*Chem. Centr.*, 1904, ii, 1668—1669; from *Verh. Ges. Deut. Ntf. Aerzte*, 1903, ii, 441—442).—Acidimetric estimations by means of gas elements with platinum or palladium electrodes are not trustworthy. A colorimetric method with an indicator or indicators is made use of. Seventeen solutions of hydrions, varying from  $2N$  to  $5 \times 10^{-15}$  gram



hydrions per litre are prepared, and each solution gives a characteristic colour with different indicators. The preparation of the standard solutions is accomplished by means of electrical conductivity determinations. When this indicator method is employed, the solutions must be such that other colorations are not present. The method is of use for homogeneous liquids only and not for cell protoplasm. Blood serum, blood plasma, saliva, kidney, urine with a fruit and vegetable diet, sea and spring water, and the fluids of various lower organisms have an acidity of from  $2-5 \times 10^{-8}$  gram hydrions per litre. Stomachic juice, urine from carnivora, and the pancreatic excretion are more acidic, and many vegetable juices have a strong acidic reaction.  $\overset{+}{\text{H}}$  and  $\overset{-}{\text{OH}}$  in concentrated solution act as a poison of living organisms.

J. J. S.

**Halphen's Reaction.** KARL FISCHER and H. PEYAU (*Zeit. Nahr. Genussm.*, 1905, 9, 81-90).—Experiments are described in which cotton-seed oils were subjected to various treatments with the object of ascertaining whether they could be made to give a negative reaction with Halphen's test. Heating the oil for 6 hours at temperatures up to  $150^\circ$  had little effect on the sensitiveness of the reaction. When heated for 6 hours at  $250^\circ$ , the oil ceased to give any coloration, but at the same time was rendered quite unedible. No change in the intensity of the coloration was observed when the oil tested had previously been treated with zinc and sulphuric acid or with 4 per cent. potassium hydroxide, either cold or at  $100^\circ$ . On the other hand, oils subjected to the action of sulphurous acid and afterwards washed with alcohol, to remove the free acids formed, ceased to give a coloration, whilst the refraction, iodine and saponification values of the oils remained practically unchanged.

W. P. S.

**Estimation of Butter-fat and Cocoa-nut Oil in Margarine.** AAGE KIRSCHNER (*Zeit. Nahr. Genussm.*, 1905, 9, 65-70).—The following method is a modification of the process previously published by K. Jensen (*Farm. Tid.*, 1903, 385). It is based on the precipitation of octoic acid by means of silver sulphate and is a continuation of the Reichert-Meissl process. The distillate obtained in the latter is filtered as usual, and 100 c.c. of the filtrate titrated with  $N/10$  barium hydroxide solution. To the neutral solution, 0.5 gram of silver sulphate is added, the mixture shaken from time to time for 1 hour, and then filtered. One hundred c.c. of the filtrate are placed in a flask, 35 c.c. of water and 10 c.c. of dilute sulphuric acid are added, and the whole distilled until 110 c.c. of distillate have been collected. The latter is filtered, 100 c.c. of the filtrate are titrated with  $N/10$  barium hydroxide, and the result calculated for 5 grams of fat. The number obtained is termed the "new value" or the second titration value. From the results of the analyses of a number of test-samples, the author shows that the amounts of butter-fat and cocoa-nut oil in margarine can be calculated from the two formulæ: percentage of butter-fat =  $4.319, N.V. - 0.456, R - 2.15$ , and percentage of cocoa-nut oil

=  $7.42R - 8.116N.V. - 3.57$ , in which *N.V.* is the "new value" and *R* the Reichert-Meissl value of the sample. W. P. S.

**Tobacco Oil.** Chemical and Physical Properties and Composition. GASPARE AMPOLA and FRANCESCO SCURTI (*Gazzetta*, 1904, 34, ii, 315—321).—The yellow oil obtained by pressing (9—10 per cent.) or extracting (30—32 per cent.) the seeds of *Nicotiana tabacum* has a pleasant odour, and a sp. gr. 0.9232 at 15°; it thickens at -15°, solidifies to a yellow mass at -25°, dissolves in 31 parts of absolute alcohol, and mixes in all proportions with ether, carbon disulphide, chloroform, or oil of turpentine. It begins to boil at about 150° and inflames at 320—375°. With sulphuric acid (Heydenreich's reaction), it gives, if not shaken, a bright yellow coloration changing to reddish-brown; after shaking, the liquid becomes dark brown. With nitric acid (Bach's reaction), it gives a dirty-white coloration, which changes to yellowish-red after five minutes' heating; when left for 12—18 hours, the liquid assumes a buttery consistency. With Hauchecorne's reagent (3 parts of pure nitric acid of 40° B. and 1 part of water), it gives an intense red coloration after 20 minutes' heating on a water-bath. When subjected to Archbutt's modification of Poutet's elaidic test, the oil remains liquid but gives a white deposit. The thermal index, as determined in Tortelli's thermo-oleometer, is 100. The percentages of oxygen absorbed (Livache's method) after 2, 3, 4, and 14 days are 5.01, 5.61, 5.84, and 6.84 respectively. The acidity of the oil is 3.49 per cent. (as oleic acid), the saponification index 190, the saponification index of the fixed fatty acids 203, the mean molecular weight of the latter 275.8, the Hehner number 94.73, and the iodine number 118.6. The fatty acids present in the oil consist mainly of oleic acid (about 25 per cent.), linoleic acid (about 15 per cent.), and palmitic acid (about 32 per cent.), with small quantities of stearic acid.

T. H. P.

**Estimation of Rosin in Shellac.** ARTHUR C. LANGMUIR (*J. Soc. Chem. Ind.*, 1905, 24, 12—17).—The author considers that the iodine absorption of a sample of shellac affords good evidence as regards the purity of the sample. From the values obtained with the best grades of commercial shellacs, it must be taken that shellacs free from rosin have an average iodine value of 18. Rosin, on the other hand, has an iodine value well above 200, with an average of 228. Wij's solution should be used for the estimation, and the absorption allowed to proceed for 1 hour. The following modification of the Storch-Morawski reaction is recommended as a qualitative test: 1 gram of the sample is gently heated with 15 c.c. of acetic anhydride and then cooled. Rosin remains in solution, whilst the greater part of the shellac separates as a gelatinous mass which is filtered off. The filtrate is collected in a test-tube and a few drops of sulphuric acid carefully introduced, agitating the filtrate a little as the acid meets it. An evanescent coloration is obtained with as little as 2 or 3 per cent. of rosin. A pure shellac gives no coloration if care be taken to avoid charring.

W. P. S.

**Estimation of Urea.** O. WENTZKI (*Chem. Centr.*, 1904, ii, 1520—1521; from *Pharm. Zeit.*, 49, 898).—The apparatus consists of

a 30 c.c. flask with a short neck into which is ground a 10 c.c. stop-cock-pipette, the upper end of which may be connected by an india-rubber tube with a gas-burette. The apparatus, when filled, weighs about 50 grams. When testing urine, 2 c.c. of the sample and 5 c.c. of a 28 per cent. sodium hydroxide solution are introduced into the flask, the pipette filled with hypobromite solution is fixed on, and after connecting it with the burette the tap is turned and the liberated nitrogen collected.

If a gravimetric estimation is preferred, 5 c.c. of urine are used, and the apparatus is weighed before and after the reaction. L. DE K.

**Detection of Archil, Cudbear, and other Lichen Colours.** LUCIUS M. TOLMAN (*J. Amer. Chem. Soc.*, 1905, 27, 25—26).—These colours may be mistaken for coal-tar dyes, as they also pass into amyl alcohol from an ammoniacal solution, and on evaporation of the alcohol leave a purple residue. This is, however, distinguished from coal-tar dyes by the fact that its aqueous solution is reduced by tin and hydrochloric acid, and then reoxidised by ferric chloride.

L. DE K.

**Action of Various Physical and Chemical Agents on the Gluten of Wheat Flour. Estimation of Gluten.** ÉMILE FLEURENT (*Bull. Soc. chim.*, 1905, [iii], 33, 81—101. Compare Abstr., 1898, ii, 627; 1902, ii, 102; and Balland, Abstr., 1897, ii, 296).—A detailed study has been made of the various factors influencing the estimation of gluten in wheat flour by washing away the starch and soluble matters with water. It is shown that a portion of the gluten (probably the globulin) is lost when distilled water or natural waters containing calcium chloride or sulphate or sodium chloride are employed, and that the best results are secured by the use of water containing calcium hydrogen carbonate. The time occupied in the isolation of the gluten should not exceed 16 minutes, the temperature of the water employed should be about 16°, and there is no advantage in allowing the dough to stand for some time before washing (compare Balland, *loc. cit.*). The gluten should be dried at 105° before weighing (compare Arpin, Abstr., 1903, ii, 119). The difficulty of satisfactorily isolating the gluten is greater with sour flours, and it is advantageous in such cases to mix sodium hydrogen carbonate with the flour in order to neutralise the free acid. When the estimation is carried out with due observance of these precautions, concordant results are obtained, which are in close agreement with those given by more elaborate chemical methods (compare Arpin, *loc. cit.*).

T. A. H.

**Estimation of Catalases in Blood.** ADOLF JOLLES (*Zeit. anal. Chem.*, 1905, 44, 1—5).—By adopting standard conditions for the action of catalase on hydrogen peroxide, the amounts of the enzyme in different samples of blood can be compared, although the quantity of peroxide decomposed is not strictly proportional to that of catalase present. The blood (0.05 c.c.), immediately after it is drawn, is diluted to 50 c.c. with 0.9 per cent. sodium chloride solution. Of



this, 10 c.c. (0.01 c.c. of blood) are mixed with 30 c.c. of a 1 per cent. solution of hydrogen peroxide (which, if acid, must first be accurately neutralised since traces of free acid inhibit the reaction), the value of which is ascertained iodimetrically. The reaction is allowed to proceed for 2 hours at 15°, and is then arrested by the addition of 10 c.c. of hydrochloric acid of sp. gr. 1.19. Small variations of temperature do not influence the result materially. Potassium iodide (20—25 c.c. of 10 per cent. solution) is then gradually added, the mixture allowed to remain for 1 hour, and the iodine titrated. The expression "catalase value" is suggested for the number of grams of hydrogen peroxide decomposed by 1 c.c. of blood. In normal blood, this value varies from 18 to 30, but generally lies between 20 and 26. No difference can be observed between the sexes, or between venous and arterial blood, but in various pathological conditions, as tuberculose, nephritis, or carcinoma, a marked diminution is observed. M. J. S.

**Apparatus for determining the Differences shown by Tobaccos when Burnt [Smoked].** J. TOTH (*Rev. internat. Falsif.*, 1904, 17, 142—145).—By means of the apparatus described, the author is enabled to numerically express the "combustibility" of a tobacco, that is to say, whether it smokes slowly or quickly as compared with other tobaccos. The tobacco is previously cut as usual, and then made into cigarettes, at least fifteen of the latter being prepared from each sample of tobacco under examination. The cigarettes should be 90 mm. in length and 8 mm. in diameter, and made as nearly as possible of the same compactness. Each lot of cigarettes is dried at 50° and kept in a stoppered bottle. One of the cigarettes is then weighed and fixed by means of an india-rubber tube to a glass tube which passes to the bottom of a Woulff's bottle containing a dilute alcoholic solution of sodium hydroxide. This bottle is connected with a second containing dilute acid, which in turn is connected with a large aspirator filled with water. The exit tube of the aspirator is fitted with a graduated tap. At the moment the cigarette is lighted, the tap is turned on, so that from 45 to 110 grams of water run out per minute, producing a pressure of 2—3 mm. of water on a manometer fixed to a side-tube on the mouth-piece. All water leaving the aspirator is collected and weighed at the end of the experiment, it being assumed that the weight in grams is equivalent to the volume in cubic centimetres of air used. The volume of air multiplied by the time (seconds) of smoking and the result divided by the weight of tobacco (less paper) taken multiplied by 1000 gives a number which is termed the "combustion value" of the tobacco. This value for Turkish tobaccos may range from 400 to 800 or more, but for one sample will not vary more than 15 to 25 if the average of 10 cigarettes is taken. W. P. S.

## General and Physical Chemistry.

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**Spectra of the Fluorides of the Alkaline Earths in the Electric Arc.** CHARLES FABRY (*Compt. rend.*, 1905, 140, 578—581).—The band spectra of the fluorides of the alkaline earths (compare Abstr., 1904, ii, 601) are a series of heads of bands and the frequency  $N$  of any particular head  $m$  is given by the equation  $N = A - (Bm + C)^2$ , where  $B$  and  $C$  are constants depending on the origin and direction of numbering, the most brilliant head being called 0, and the succeeding ones 1, 2, 3, &c., in decreasing order of intensity. The values of  $A$ ,  $B$ , and  $C$  for corresponding series of calcium and strontium fluorides are given in the original, and the following conclusions are drawn: (1) the constant  $A$  is greater in the case of calcium than of strontium, that is, the series is displaced towards the greatest wave-length as the atomic weight of the metal increases; (2) the constant  $C$  has the same value for analogous series of the two salts; (3) the constant  $B$  diminishes on passing from a calcium series to the analogous series of strontium. In the case of barium fluoride,  $B < 0$ .  
M. A. W.

**Emission Spectra of Metals in the Electric Furnace.** ARTHUR S. KING (*Ann. Physik*, 1905, [iv], 16, 360—381).—The metals or their salts were placed in an electric furnace similar to that previously used by Liveing and Dewar for the same purpose (see *Proc. Roy. Soc.*, 1882, 34, 119), and raised to a temperature estimated as 2500° abs. The spectra observed are free from the influence of electrical conditions under which arc and spark spectra have been obtained, for the arc used by the author serves only to raise the furnace to a high temperature. The method is especially suited for the production of band spectra. Numerous lines also have been observed, the intensities of which differ markedly from those of the arc spectrum lines. The metals investigated were caesium, calcium, strontium, barium, iron, copper, magnesium, mercury, and zinc. The two last metals, however, gave no lines. For details of the spectra of the other metals, the original must be consulted.  
J. C. P.

**Relations existing between Constitution and Absorption Spectra of the Thiazines and Thiazones.** JULIUS FORMÁNEK (*Zeit. Farb. Text. Chem.*, 1905, 4, 33—38, 61—67).—Measurements are given of the absorption spectra of thionine chloride and of a large number of its methyl and ethyl derivatives in aqueous, ethyl-alcoholic, and amyl-alcoholic solution. Similar considerations to those already brought forward in a previous paper (Abstr., 1904, ii, 106) are developed with regard to the influence of alkyl groups on the displacement of the absorption lines.  
W. A. D.

**Kehrmann's Explanation of Change of Fluorescence.** HUGO KAUFFMANN and ALFRED BEISSWENGER (*Ber.*, 1905, **38**, 793—794. Compare Abstr., 1903, i, 700; 1904, ii, 528; and Kehrmann, *ibid.*, 797).—The fluorescence of 1:4-dimethoxyacetophenone and  $\alpha$ -methylvinyl-quinol dimethyl ether (this vol., i, 280) cannot be due to the change in position of ortho-quinonoid linkings, as assumed in other cases by Kehrmann. J. J. S.

**Present Problems of Radioactivity.** ERNEST RUTHERFORD (*Arch. Sci. phys. Nat.*, 1905, [iv], **19**, 31—59).—A memoir in which the most important problems connected with radioactivity are discussed, and wherein are indicated the subjects which, in the author's opinion, require further research. Theoretically, the apparent mass of an electron rapidly increases when its velocity approaches that of light, becoming infinitely great when equal to this. Hence it may be concluded that it is not possible for a charged substance to move with a velocity greater than that of light; on this account, a deeper study of the high-speed electrons is desirable. Further researches on the  $\alpha$ -rays are also required in order to decide whether the  $\alpha$ -particles, which are of the same order of magnitude as the hydrogen atom, are positively charged when expelled, or whether these particles are not charged at the instant of expulsion, but acquire a positive charge by reason of impacts with particles of matter, whereby they lose a negative electron. The apparent non-existence of a positive electron has also to find a satisfactory explanation. The penetrating power of the  $\alpha$ -polonium rays is less than that of the  $\alpha$ -radium rays, hence probably their velocity is less. This indicates that the value  $e/m$  is different for these, and hence the determination of the velocities is important. The curves for calorific effect for the radium transformations agree with those for the activity measured in  $\alpha$ -rays, and the question naturally arises whether the bombardment by these particles is sufficient to account for the calorific effect. The number of  $\alpha$ -particles emitted per second per gram of radium has been calculated as about  $3 \times 10^{11}$ , that necessary to account for the calorific effect is from  $2 \times 10^{11}$  (Rutherford) to  $5 \times 10^{11}$  (Des Coudres), an accord which is sufficiently close to allow it to be supposed that the heat is solely due to the  $\alpha$ -particles, the energy due to  $\beta$ - and  $\gamma$ -rays being small by comparison. Radiation of energy due to rearrangement of the components after the expulsion of the  $\alpha$ -particle might be expected, and experiments on this point are desirable. The source of the energy is discussed and the two hypotheses of internal and external sources are considered, the former being regarded as the more satisfactory. The cause of the explosive disintegration of the atom has, however, yet to be explained (compare Abstr., 1904, ii, 223, 799). L. M. J.

**Electrical Radiography.** V. GABRITSCHIEWSKI (*Chem. Centr.*, 1905, i, 493; from *Physikal. Zeit.*, **6**, 33—34).—If a radium preparation and any flat object are brought for a few minutes into the immediate neighbourhood of an electrified ebonite plate, then on dusting the latter with a finely divided mixture of sulphur and red lead, a sharply outlined dust-figure of the object is formed on the ebonite plate.



The object does not need to be in contact with the ebonite plate nor with the radium preparation; if the latter is placed on the opposite side of the plate, the figures make their appearance. The author assumes the existence of a special force which attracts the electrical charge of the plate towards the object in its vicinity.

H. M. D.

**Action of Radium Bromide on the Electrical Resistance of Metals.** BRONISLAS SABAT (*Compt. rend.*, 1905, 140, 644—646).—The metals (iron, platinum, copper, bismuth) or alloys (brass, German silver) in the form of wires of 0.1 mm. diameter were wound on a paper cylinder and subjected to the action of 0.2 gram of radium bromide contained in a thin glass tube, which was placed in the interior of the cylinder. In all cases, a small increase in the electrical resistance was observed, and this increase was greater than can be attributed to the heating effect of the radium. The total effect is not instantaneous, but a gradual increase to an almost constant maximum is observable.

The observed maximum increase in the resistance of the iron wire examined would correspond with a rise of temperature of  $1.6^{\circ}$ , whereas the rise of temperature due to the heating effect of the radium is computed to be less than  $0.3$ — $0.4^{\circ}$ . On removing the radium, the resistance sinks slowly to its original value. The author supposes that the metals absorb the  $\beta$ -rays, and that the energy of these rays is transformed into heat energy.

H. M. D.

**Ionisation due to Radium Emanation.** WILLIAM DUANE (*Compt. rend.*, 1905, 140, 581—583).—The saturation electric current that can be passed across the gas contained in a vessel into which radium emanation is introduced increases rapidly during the first ten minutes, then more slowly, attaining a maximum in about three hours. The initial current is represented by the equation  $d = b - k.S/V$ , where  $b$  is the current that would be produced by unit quantity of emanation if all its radiation were absorbed by the air, and  $k.S/V$  is the correction due to the radiation absorbed by the walls of the vessel of surface  $S$  and volume  $V$ .

M. A. W.

**Action of Radium Rays on Mixtures of Hydrogen and Chlorine.** WILLIAM P. JORISSEN and WILHELM E. RINGER (*Ber.*, 1905, 38, 899—904).—A summary of the observed cases of chemical action under the influence of radium rays is given. Previous experiments with mixtures of hydrogen and chlorine have given a negative result. The gas mixture was obtained by electrolysis of 25 per cent. hydrochloric acid, and was subjected to the influence of radium bromide in an apparatus resembling a Bunsen ice calorimeter. The radium salt (5 mg.) was placed in the inner thin-walled tube, the gas mixture being contained in the outer larger vessel, into which was sealed a capillary tube, on which any alteration in volume of the gas mixture exposed to the action of the radium was indicated. Disturbances resulting from alteration in the atmospheric pressure were eliminated by a special contrivance. The apparatus was immersed in a thermostat

maintained at  $25^{\circ}$  and the gas mixture exposed to the radium in the dark. The meniscus of the liquid confining the gas was observed slowly to alter its position in the capillary tube. The same effect was observed when the radium tube was coated with a layer of black varnish in order to cut off the phosphorescent light of the radium. H. M. D.

**Molecular Weights of Radium and Thorium Emanations.** WALTER MAKOWER (*Phil. Mag.*, 1905, [vi], 9, 56—77).—The molecular weights of the emanations were determined from comparison of the rate of diffusion with that of gases of known molecular weight, namely, oxygen, carbon dioxide, and sulphur dioxide. Some interesting results were obtained in the preliminary experiments. The diffusion constant with the same plug was found to vary with pressure, a result the author considers to be due to the pores of the plug being comparable in size with the mean free path of gas molecules. The values for hydrogen and carbon dioxide were not in the inverse ratios of the squares of the densities, the result being explicable by differences due to gravitational causes. As the values for  $\lambda\sqrt{M}$  were not constant, a curve for  $\lambda\sqrt{M}$  against  $\lambda$  was drawn for the known gases, from which from the value of  $\lambda$  for the radium emanation, the value of  $M$  is obtained. The results lead to the values 85.5, 97, and 99, so that, if monatomic, it probably occupies the vacancy in the periodic table between Mo = 96 and Ru = 102. The determination of the rate of diffusion of the thorium emanation was rendered more difficult owing to its rapid rate of decay, but full accounts of the methods employed for this and the previous determination are given. The ratio of  $\lambda$  (thorium) to  $\lambda$  (radium) was found to be 1 : 0.931.

L. M. J.

**Emanium.** FRIEDRICH GIESEL (*Ber.*, 1905, 38, 775—778. Compare Abstr., 1904, ii, 800).—A product much richer in emanium is obtained when the rare earths are carried down with barium sulphate; by this method, considerable amounts of lanthanum are removed. Fractional precipitation with magnesia may also be used for purifying the emanium; this and lanthanum are least readily precipitated.

The active substances which can be separated from emanium by means of ammonia are termed Emanium X or EX, and are also removed by precipitated barium sulphate or other precipitates.

The three lines previously described as characteristic of emanium have been found to be due to didymium—lines  $\lambda$  590 and 530 to neodymium, and lines  $\lambda$  530 and 488 to praseodidymium. J. J. S.

**Radioactivity of Certain Fresh-water Springs of the Taunus.** A. SCHMIDT (*Chem. Centr.*, 1905, i, 492; from *Physikal. Zeit.*, 6, 34—37).—By means of a piston, 600 c.c. of air were forced through 600 c.c. of the water under examination and introduced into a closed cylinder of metal containing an Exner's electroscope. The rate of fall of potential was then measured. Of nine samples which were examined, three were found to be active. The activity is present in the waters in the form of emanation, which is removed by the air forced through them.

In examining a spring-water for radioactivity, the method adopted is to determine the rate of fall of potential in the air forced through the water immediately after the sample has been taken, the measurement being repeated with air forced through the water four days later. If the ratio of the rates of fall of potential is 2 : 1, the authors conclude that the water is radioactive. The fresh-water springs of Wiesbaden are more active than the hot springs, the evolution of gas from the latter removing the emanation. Apart from the emanation, however, the hot springs appear to contain a radioactive element.

H. M. D.

**Radioactivity of Mineral Springs.** G. A. BLANC (*Phil. Mag.*, 1905, [vi], 9, 148—154).—The author examined the radioactive properties of the deposits from a number of mineral and thermal waters of the Alpine regions, a list of the sources being given. It was found that most produced a certain amount of emanation, the rate of decay of which was approximately equal to that of the radium emanation. Some very active deposits, however, produced very little emanation, or else a very rapidly decaying emanation. Further experiments showed the latter to be present, the emanation losing half its activity in about one minute, and producing secondary activity which decays to half its value in about eleven hours; this is hence probably a thorium emanation.

L. M. J.

**The Wiesbaden Thermal Springs and their Radioactivity.** FERDINAND HENRICH (*Monatsh.*, 1905, 26, 149—184. Compare this vol., ii, 6; Fresenius, *Abstr.*, 1887, 647).—The gas obtained from the Kochbrunnen, Wiesbaden, was found to consist of 84.5 per cent. of carbon dioxide, including traces of hydrogen sulphide, 0.1 per cent. of oxygen, and 15.4 per cent. of nitrogen and argon; the gas from the Adler spring contained 75.4 per cent. of carbon dioxide with traces of hydrogen sulphide, 1 per cent. of oxygen, and 23.6 per cent. of nitrogen and argon; the gas from the Schützenhof spring contained 63.2 per cent. of carbon dioxide with traces of hydrogen sulphide, 0.2 per cent. of oxygen, and 67.2 per cent. of nitrogen and argon. The composition of the gas from the same spring is not always the same, and the gases from different jets in the same spring basin vary in their composition. The gas from the Kochbrunnen was found to affect a photographic plate. The electrometrical examination of the gases from these three springs showed that in each case the radioactivity of the gas was increased by removal of the carbon dioxide, and to a still greater extent by removal of the nitrogen; the residual gases exhibited the spectrum of argon, but neither of helium nor of radium emanation. The gases obtained by boiling the water of these three springs and of the Faulbrunnen were also found to be radioactive. The solid deposited by the water close to the spring consists principally of ferric oxide and its salts, whilst further from the spring the water deposits calcium carbonate in the form of aragonite; these deposits are strongly radioactive. The residue obtained on evaporation of the water consists principally of sodium chloride, and is only slightly radioactive.

G. Y.



**Influence of Temperature on the Electrical Conductivity of Lithium.** ARCIERO BERNINI (*Chem. Centr.*, 1905, i, 496; from *Physikal. Zeit.*, 6, 74—78).—The molten lithium was pressed into a glass tube, the walls of which were coated with a thin layer of oil; by this means, the formation of cavities in the solidified metal could be avoided. In the measurement of the electrical conductivity, a correction was applied for this layer of oil. The electrical resistance of lithium alters considerably more than that of sodium and potassium when change in the state of aggregation takes place. From the electrical resistance curves, the melting point of lithium is  $177.84^{\circ}$  (Bunsen,  $180^{\circ}$ ). The specific resistance of solid lithium at  $0^{\circ}$  is 0.089285, of molten lithium at  $230^{\circ}$ , 0.452484. The temperature-coefficient for solid lithium between  $0^{\circ}$  and its melting point is 0.004568, for molten lithium between the melting point and  $230^{\circ}$ , 0.002729. In opposition to previous statements, lithium melts quite sharply as indicated by the electrical measurements. The ratio of the specific resistances at the melting point is equal to 2.51.

H. M. D.

**Halogen Hydrides as Conducting Solvents. III. Transport Numbers.** BERTRAM D. STEELE (*Proc. Roy. Soc.*, 1905, 74, 320. Compare McIntosh and Steele, *Abstr.*, 1904, ii, 533; Archibald and McIntosh, *ibid.*, 534).—As a preliminary step, Faraday's law was shown to be valid for solutions in liquefied hydrogen bromide within the limits of the experimental error of the method employed. Transport numbers were then determined at  $-81^{\circ}$  for ether, acetone, methyl hexyl ketone, and triethylamine hydrobromide in hydrogen bromide solution. These substances, the first two of which have been shown to form compounds with hydrogen bromide, are found to travel towards the cathode, and the cation transport number increases with increasing concentration.

J. C. P.

**Halogen Hydrides as Conducting Solvents. IV.** BERTRAM D. STEELE, DOUGLAS MCINTOSH, and EBENEZER H. ARCHIBALD (*Proc. Roy. Soc.*, 1905, 74, 321—322. Compare preceding abstract).—To explain the abnormal variation of the molecular conductivity with dilution for solutions in which the halogen hydrides act as solvents (see *Abstr.*, 1904, ii, 534), it may be assumed that the dissolved substance combines with the solvent, and that the resulting compound undergoes ionic dissociation. This view is supported by experiments on solutions of hydrogen cyanide and triethylamine hydrochloride in hydrogen chloride, and of acetone in hydrogen bromide. In the latter case, 3 molecules of solute, in the former cases, 2 molecules of solute, combine with the solvent to form the dissociating substance. The association of solute and solvent in such cases is indicated also by the high values obtained for the molecular weight.

J. C. P.

**Electromotive Behaviour of Bromine and the Anodic Potential in the Electrolysis of Neutral Solutions of Potassium Bromide.** F. BOERICKE (*Zeit. Elektrochem.*, 1905, 11, 57—88).—The solubility of liquid bromine in water is 0.2595 gram-molecule per litre at  $0^{\circ}$  and 0.2125 gram-molecule per litre at  $25^{\circ}$ . Bromine

hydrate is less soluble, the saturated solution containing 0.152 gram-molecule of bromine at 0°.

The following table gives the solubility of bromine and bromine hydrate in solutions of potassium bromide; the concentrations are expressed in gram-molecules of potassium bromide or bromine per litre :

Concentration KBr.	Concentration of Br <sub>2</sub> .		Concentration of KBr.	Concentration of Br <sub>2</sub> at 25°.
	Bromine, 0°.	Bromine hydrate, 0°.		
3.033	4.606	—	3.00	3.955
2.17	3.200	3.200	1.00	1.354
1.82	2.650	2.645	0.50	0.744
1.725	2.515	2.475	0.33	0.564
1.00	1.520	1.360	0.20	0.421
0.501	0.8666	0.700	0.10	0.3085
0.330	0.6510	—	0.033	0.2500
0.199	0.4945	0.3575		
0.100	0.3770	0.250		
0.033	0.2935	—		
HBr.			HBr.	
1.00	1.690	1.565	1.00	1.4975
0.10	0.3770	0.262	0.10	0.324

At 0°, bromine, bromine hydrate, and 1.83 normal potassium bromide solution saturated with bromine are in stable equilibrium. The author concludes from the figures given that, whilst the greater part of the dissolved bromine probably exists as KBr<sub>3</sub>, molecules of the formula KBr<sub>5</sub>, and possibly KBr<sub>7</sub>, must also exist.

The potential of bromine,  $-\epsilon_0$ , is calculated by means of the equation  $-\epsilon = -\epsilon_0 + 0.0298 \log C_{\text{Br}_2} / (C_{\text{Br}}')^2$  from a large number of determinations of the *E.M.F.* of cells containing a platinum electrode immersed in a saturated solution of bromine in potassium bromide. The concentrations of free bromine and of bromine ions are calculated on the assumption that (in the weaker solutions) only KBr<sub>3</sub> molecules are formed, that KBr<sub>3</sub> and KBr are equally dissociated, and that this dissociation can be calculated from the conductivity. The mean value of  $-\epsilon_0$  (referred to the hydrogen electrode) is 1.098 volts.

The result of a very large number of experiments on the potential of the anode in the electrolysis of potassium bromide solutions is that the great solubility of bromine in water or a solution of a bromide allows bromine ions to be discharged reversibly at a platinised platinum anode at potentials lower than the potential of bromine in a saturated solution, whereas at a smooth platinum anode a change takes place in the electrode (probably a layer of gaseous bromine condenses on its surface) which makes it necessary to increase the potential considerably above that of bromine in a saturated solution in order to produce an appreciable current.

T. E.

**Polarisation observed during Cathodic Liberation of Hydrogen.** JULIUS TAFEL (*Zeit. physikal. Chem.*, 1905, 50, 641—712. Compare Abstr., 1900, ii, 588).—In the author's experiments, a

platinum anode was used in all cases, dilute sulphuric acid was the electrolyte, and the cathode consisted of mercury, cadmium, lead, silver, copper, nickel, bismuth, tin, gold, or platinum. The polarisation was determined while electrolysis was proceeding, as evidenced by the distinct liberation of hydrogen. The cathode potential,  $\epsilon$ , and the cathode current density,  $I$ , are related by the equation  $\epsilon = a + b \log I$ , where  $a$  and  $b$  are constants for a given temperature (compare Jahn and Schönrock, Abstr., 1895, ii, 178; Jahn, Abstr., 1898, ii, 496; Haber, Abstr., 1900, ii, 257; Russ, Abstr., 1903, ii, 631; Haber and Russ, Abstr., 1904, ii, 309). The potentials for all the metals decrease as the temperature rises, but in the case of mercury it was found that  $b$  increases with rising temperature. The foregoing formula is especially accurate for a mercury cathode over a wide range of current density, but its applicability is masked in the case of the other metals (except perhaps lead) by secondary causes. In studying these secondary causes, it is therefore necessary to compare values of the cathode polarisation which have been obtained with a given current density.

The primary influence of the cathode surface, so far as its mechanical properties are concerned, appears to be comparatively slight; for example, polished and prepared lead electrodes have approximately the same polarisation values. But the cathode process itself effects mechanical and chemical changes at the surface of the cathode, and these changes influence the potential values so that the latter are more or less dependent on the previous history of the cathode. Some metals (lead, cadmium, silver, and copper) exhibit two distinct polarisation states when the anode liquid has access to the cathode, a state of "elevation" and a state of "depression." The change from the one to the other takes place during electrolysis, and often occurs suddenly. Cathode process and anode liquid are opposed to each other, and what leads to the state of depression is some change in the cathode surface induced by an unknown product of the anode process.

The potential at all the cathodes (those of platinised platinum and mercury excepted) changes slowly during electrolysis. When the cathode is protected from the anode liquid, lead, cadmium, tin, and bismuth all reach a polarisation maximum within a short time, up to half an hour in the last two cases. With copper, nickel, gold, and bright platinum, the cathode potential for a given current density goes on increasing for hours, and with platinum no maximum value can be reached at all. The author considers that the experimental data are rather opposed to the view of varying polarisation as due to the varying thickness of a gaseous layer on the electrode. He himself regards the cathode surface as having in different cases a different catalytic effect on the process of formation of hydrogen gas. J. C. P.

**Relation between Cathode Potential and Electrolytic Reducing Action.** JULIUS TAFEL and KURT NAUMANN (*Zeit. physikal. Chem.*, 1905, 50, 713—752. Compare preceding abstract).—The electrolytic reduction of caffeine and succinimide in sulphuric acid can be effected only with cathodes of cadmium, lead, and mercury. In the case of lead, however, the reduction cannot be effected if the cathode potential is by any method reduced below about 1.65 volts. Caffeine



is reduced more rapidly at a mercury cathode than at a lead cathode, but the behaviour of succinimide is exactly the reverse, although the cathode potentials of the two metals in pure acid are the same. In the electrolysis of sulphuric acid with mercury cathode, the addition of caffeine leads to depolarisation. With a lead cathode, small quantities of caffeine effect a rise of the cathode potential, larger quantities lower the potential. Succinimide raises the potential at both mercury and lead cathodes. Addition of caffeine at a tin cathode leads to depolarisation, although no reduction of the caffeine can be detected. When caffeine is reduced at a mercury cathode, then for a given current strength the relation  $\epsilon = a + b \log(100 - N)$  holds, where  $\epsilon$  is the cathode potential during the reduction and  $N$  is the reduction efficiency ("Nutz-effekt"). When caffeine is reduced at a lead cathode, the potential of which in pure acid is varied by the precipitation of foreign metals, then for a given current strength and caffeine concentration the relation  $\epsilon = a_1 + b_1 \log N$  holds. These results are in harmony with the observations of Haber and his pupils on the reduction of nitrobenzene without evolution of hydrogen. They can be interpreted by supposing that the formation of hydrogen gas and the reduction at the cathode are completely co-ordinated non-reversible processes, and that the cathode potential is due to the forced accumulation of hydrogen in some form or other in the surface layer of the cathode. J. C. P.

**Theory of Electrocapillary Phenomena. III. JEAN BILLITZER** (*Zeit. physikal. Chem.*, 1905, 51, 167—192).—Recent work has shown that the capillary constant of mercury not only depends on the density of the electrical double layer, but is a function also of the potential difference. In the present paper, the author deduces and discusses a form of this function. J. C. P.

**The Aluminium Rectifier. S. BARCLAY CHARTERS** (*J. Physical Chem.*, 1905, 9, 110—148).—The behaviour of an aluminium rectifier is best explained by the assumption that the electrode becomes coated with a film of aluminium hydroxide which is impermeable to certain ions, for example,  $\text{SO}_4''$  and  $\text{Al}'''$ , but permeable to others, such as  $\text{H}'$ ,  $\text{Cl}'$ ,  $\text{Br}'$  (*Abstr.*, 1903, ii, 260). When a low voltage is applied and slowly increased with clean aluminium electrodes, a considerable current is first produced, which gradually sinks as the film increases, until a steady low value is reached—the leakage current, which increases slowly with the voltage until a certain critical value of the voltage is obtained above which the current increases rapidly, the film being ultimately ruptured at what is termed the "break-down point." Experiments were first made to determine the critical values with various electrolytes, and the method employed is described, tables and curves of the results being given. Sulphuric acid and solutions of disodium phosphate and citric acid were employed; the critical value of sulphuric acid was lowest, about 55 volts, that of dilute citric acid was highest, but in this case, owing to steady rise of the leakage current, the solution cannot be worked above about 325 volts. The other two solutions yielded a critical value of about 300 volts, the same value being obtained with phosphoric acid at a concentration of maximum

conductivity, and this solution was employed in the 4-cell rectifier described. The rectifier was arranged to secure all the current, and lead graphite was employed as the second electrode. Numerous experiments on the efficiency of the rectifier were made, and curves are given. A current efficiency of about 75—80 per cent. was readily obtained; the voltage efficiency, however, is only about 30 to 35 per cent., and the energy efficiency about 20 to 30 per cent. The loss of voltage is best explained by assumption of a counter *E.M.F.*

L. M. J.

**Behaviour of Anodes of Iridium, Platinum, and Rhodium in the Electrolysis of Dilute Sulphuric Acid.** J. B. WESTHAVER (*Zeit. physikal. Chem.*, 1905, 51, 65—94).—Anodes of iridium, platinum, and rhodium in *N*/10 sulphuric acid behave differently. When the current density is high, iridium is the least polarisable, followed by rhodium; at low values of the current density, platinum is less easily polarised than iridium. A considerable interval elapses before the stationary condition of affairs is reached; at low current densities, the most rapid electrodes in this respect are those obtained by covering a glass surface with a liquid containing iridium salt, and then evaporating and igniting. With such burnt electrodes, coated with iridium black, the *E.M.F.* of the hydrogen-oxygen cell with *N*/10 sulphuric acid is found to be 1.06 volts at the ordinary temperature, this final value being reached both from above and from below. With platinised electrodes a temporary rise of the *E.M.F.* to 1.1 volts is observed. Oxygen electrodes completely immersed in the liquid exhibit an *E.M.F.* of only 0.9 volt, even after prolonged passage of oxygen. The curves showing the relation between potential and current density exhibit marked hysteresis in the case of platinum and platinum black. The mere occurrence of discontinuities or points of marked curvature on the potential current curves is not sufficient to warrant conclusions as to the electrode processes, for the electrode potentials corresponding with these points depend on the scale of the curves and the accuracy of the method used to determine the current. The author shows that when the logarithm of the current is plotted against the electrode potential, curves are obtained for the various kinds of platinum and iridium electrodes, which all exhibit a break at 1.45 volts. Electrodes of iridium black, on account of their small polarisation, are suitable for determinations of conductivity with alternating current and a telephone.

J. C. P.

**Dissociation of Ternary Electrolytes.** GOTTFRIED KÜMMEL (*Zeit. Elektrochem.*, 1905, 11, 94—99).—The author has extended the work previously described (*Abstr.*, 1904, ii, 111). Solutions of magnesium chloride are examined at six temperatures between 15° and 30°. The concentrations of the  $\text{MgCl}^+$  ions calculated by means of the transference numbers are often smaller than the minimum values calculated by the method of isohydric solutions. This discrepancy is attributed to the inaccuracy of two assumptions on which the calculations are based; these assumptions are: (a) the concentration of the  $\text{Cl}^-$  ions in a solution of potassium chloride can be calculated from its conductivity;

(b) the transference numbers are independent of the concentration. On the whole, however, it appears that the concentration of the  $\text{MgCl}^-$  ions increases rapidly as the temperature rises. Similar experiments are described with calcium chloride and nitrate, barium chloride, potassium oxalate, and lithium sulphate. The results obtained with the calcium and barium salts are very similar to those obtained with magnesium chloride; potassium oxalate also gives similar results. The transference number for K in potassium oxalate is found to be 0.76 in 2*N*- and 0.74 in *N*-solutions at 25°. The transference number for Li in  $\text{LiSO}_4$  at 25° is found to be 0.35 in 2*N*-, 0.37 in *N*-, and 0.39 in 0.5*N*-solutions. The values of the concentrations of the ion  $\text{LiSO}_4'$  found by the two methods agree much better in this case than in any other; at 25° they are:

Litres per gram equivalent $\text{Li}_2\text{SO}_4$ ...	0.5	0.571	0.667	1	2	10
Concentration of $\text{Li}^+$ ions .....	0.930	0.847	0.752	0.546	0.303	0.0692
Concentration of $\text{LiSO}_4'$ ions. {	Maximum .....	0.930	0.789	0.654	0.404	0.157
	Minimum .....	0.530	0.454	0.376	0.233	0.0051
	From transference number .....	0.717	0.597	0.499	0.301	0.106

T. E.

**Electrolysis with Alternating Current.** ANDRÉ BROCHET and JOSEPH PETIT (*Zeit. Elektrochem.*, 1905, 11, 102).—Reply to Le Blanc (this vol., 137) and Ruer (*ibid.*).  
T. E.

**Electrolysis of Organic Acids by means of an Alternating Current.** ANDRÉ BROCHET and JOSEPH PETIT (*Compt. rend.*, 1905, 140, 442—444. Compare this vol., ii, 7, 27, 28).—Solutions of formic acid, formates, or oxalic acid are electrolytically decomposed by means of an alternating current, yielding the same products as are obtained when a continuous current is employed, but the yields, which vary with the current density, are much higher; in the case of formic acid with a current density of one ampere per sq. centimetre, the yield is 46 per cent. of the theoretical, with 0.5 ampere it is 10—12 per cent., and with 0.25 ampere it is 5 per cent.; the corresponding values for potassium formate are 80—90 per cent., 30—40 per cent., and 10—15 per cent., whilst the yield of gaseous products from oxalic acid is 80 per cent. for a current density of 1 ampere per sq. centimetre. The alternating current has no definite action on acetic acid solutions.

M. A. W.

**Registration of Atmospheric Ionisation by means of Falling Water.** CHARLES NORDMANN (*Compt. rend.*, 1905, 140, 430—433).—A description and diagram of an arrangement for obtaining a continuous record of the ionisation of the atmosphere (compare *Compt. rend.*, 1904, 138, 1418, 1596); the air circulates between the plates of a cylindrical condenser and the charge introduced by the ions is carried off by drops of water falling regularly from a Mariotte bottle; the deviations of the electrometer connected with the condenser are proportional to the number of ions per unit volume of the gas, and a photographic record of the deviations is obtained on a mechanically rotating cylinder.

M. A. W.



**Magnetic Hysteresis at High Frequencies.** CH. EUG. GUYE and A. SCHIDLOF (*Arch. Sci. phys. Nat.*, 1905, [iv], 19, 60—79).—The authors have compared by a bolometric method the energy lost per second by hysteresis in coils of iron, nickel, and nickel steel in fields of varying intensity and at frequencies varying from 125 to 1200. It is found that the energy lost per second is proportional to the frequency, and hence that the energy lost in each cycle of magnetism is independent of the time of the cycle within the limits of 100 to 1200 cycles per second.

L. M. J.

**Magnetisation and Resistance of Nickel Wire at High Temperatures.** C. G. KNOTT (*Trans. Roy. Soc. Edin.*, 1904, 41, 39—52).—The experiments deal with the effect of longitudinal magnetisation on the electrical resistance of nickel wire up to 400°, the temperature about which nickel loses its pronounced magnetic properties. The results are summarised in two sets of graphs, namely, (1) isothermals, showing the relation between magnetising force and resistance change at various temperatures, and (2) isodynamics, showing the relation between resistance change and temperature in the various fields. In the higher fields, the resistance change diminishes as the temperature rises and is practically non-existent above 350°. Hence it appears that the change in question is a function not of the magnetising force but of the magnetisation or induction in the nickel. The isodynamic curves further indicate a peculiarity at or near 180°. This is probably connected with the abnormal thermoelectric behaviour of nickel at 180—200°, and with the abnormal temperature-coefficient of the resistance of nickel at the same temperature.

J. C. P.

**Coefficient of Magnetisation of Bismuth: Some Points of Reference in the Diamagnetic Scale.** GEORGES MESLIN (*Compt. rend.*, 1905, 140, 499—502).—The author has redetermined the value of the coefficient of magnetisation of crystalline bismuth and finds  $-1.42 \times 10^{-6}$ ; Faraday found  $-1.64 \times 10^{-6}$ ; Becquerel,  $-1.75 \times 10^{-6}$ ; Curie,  $-1.35 \times 10^{-6}$ ; and Ettingshausen,  $-1.44 \times 10^{-6}$ . For potassium sulphate or nitrate, the value of the coefficient is  $-0.42 \times 10^{-6}$  or  $0.32 \times 10^{-6}$  respectively, and these agree closely with the values found by Curie, namely,  $-0.43 \times 10^{-6}$  for potassium sulphate and  $-0.33 \times 10^{-6}$  for potassium nitrate.

M. A. W.

**Specific Heat of Gases at High Temperatures.** LUDWIG HOLBORN and L. AUSTIN (*Sitzungsber. K. Akad. Wiss. Berlin*, 1905, 175—178).—The mean specific heats at constant pressure of nitrogen, air, oxygen containing 9.5 per cent. of nitrogen, and carbon dioxide have been determined by Regnault's method over the temperature ranges 20—440°, 20—630°, 20—800°. From the specific heat of the impure oxygen just referred to, the specific heat of pure oxygen has been calculated. The values found for the mean specific heats are given in the following table:

Temp. range.	Nitrogen.	Oxygen.	Air.	Carbon dioxide.
20—440°	0.2419	0.2240	0.2366	0.2306
20—630	0.2464	0.2300	0.2429	0.2423
20—800	0.2497	—	0.2430	0.2486

It is not possible from these results to say with certainty that the specific heat of the simple gases increases with rising temperature. When the specific heat of carbon dioxide at a definite temperature is calculated from the mean specific heats, the following numbers are obtained:

Temperature.	Specific heat.	Temperature.	Specific heat.
0°	0·2028	400°	0·2502
100	0·2161	600	0·2678
200	0·2285	800	0·2815

The values at the higher temperatures are lower than those deduced indirectly by previous workers. J. C. P.

**Effect of Liquid Air Temperatures on the Mechanical and other Properties of Iron and its Alloys.** Sir JAMES DEWAR and ROBERT A. HADFIELD (*Proc. Roy. Soc.*, 1905, 74, 326—336).—The effect of low temperature on iron and iron alloys is, in general, to increase their tenacity and reduce their ductility. This does not apply, however, to the alloys containing nickel. Whereas pure iron becomes extraordinarily brittle at low temperatures, the effect of these conditions on nickel is to increase both its tenacity and its ductility, and the influence of the latter characteristic may be marked in the iron-nickel alloys. The nickel, in fact, acts as a preventive of brittleness at low temperatures, provided the percentage of carbon in the alloy is not too great. Even in an iron alloy containing 6 per cent. of manganese and 24 per cent. of nickel, the latter metal causes the alloy to remain ductile at the temperature of liquid air. J. C. P.

**Melting Points and Transition Points of some Salts.** K. HÜTTNER and GUSTAV TAMMANN (*Zeit. anorg. Chem.*, 1905, 43, 215—227).—In determinations of the melting points of salts, the curves of cooling over as large a temperature range as possible should be observed in order that the transition points of one crystalline form into another may be noted. The curve of cooling also indicates the relationship between the heat of transition and the heat of fusion. The transition proceeds in such a manner that the amount of substance which crystallises in unit of time gives up an amount of heat which is just sufficient to maintain the temperature constant for a time. The amount of salt transformed in unit of time depends on the temperature, on the linear rate of crystallisation with which the single crystals separate in the molten mass, and on the nature of the distribution of the crystals in the molten mass.

The curve of cooling of lithium sulphate is represented, the ordinates indicating temperatures and the abscissæ time in seconds. From observations of temperature during the crystallisation of the first half of the salt, conclusions can be drawn as to whether any substance is present in admixture with the salt.

The relationship between heat of transition and heat of fusion is discussed. The latter is always greater than the former for any given salt.

The melting and transition points of a number of inorganic salts

were determined. Many of the melting points determined by the authors are widely at variance with values previously obtained by Braun, Carnelley, Le Chatelier, and others.

A. McK.

**Vapour Tension of Solid Solutions. II.** ALEXANDER W. SPERANSKY (*Zeit. physikal. Chem.*, 1905, 51, 45—58. Compare Abstr., 1904, ii, 237).—With the apparatus previously described, the author has determined the vapour tensions at various temperatures of *p*-dibromobenzene (solid), *p*-chlorobromobenzene (m. p. 64.7°; solid and liquid), *p*-dichlorobenzene (solid and liquid), and of isomorphous mixtures of *p*-dibromobenzene with *p*-chlorobromobenzene, and of *p*-dibromobenzene with *p*-dichlorobenzene. From the vapour pressure curves for solid and liquid *p*-dichlorobenzene and *p*-chlorobromobenzene, it is possible to calculate the freezing point (that is, the intersection of the curves) in good agreement with experiment. From the vapour tensions of the isomorphous mixtures, it appears that in a solid solution of *p*-dibromobenzene in *p*-chlorobromobenzene the molecules of the former substance are simple, while in a solid solution of *p*-dibromobenzene in *p*-dichlorobenzene the molecules of the former substance at high concentrations are double. The result is the same as has been deduced from the study of the liquid solutions. Since the solution laws are thus applicable in the case of these isomorphous mixtures, it may be concluded that the surface of the solid does not play an important part.

J. C. P.

**Determination of Molecular Weight in Solid Solutions. IV. Vaporisation of Isomorphous Mixtures of *p*-Dichlorobenzene and *p*-Dibromobenzene.** FRIEDRICH W. KÜSTER [with GEORG DAHMER] (*Zeit. physikal. Chem.*, 1905, 51, 222—242. Compare this vol., ii, 80; also Speransky, preceding abstract).—An elaborate apparatus has been devised for determining the vapour pressures of *p*-dichlorobenzene, *p*-dibromobenzene, and isomorphous mixtures of the two substances. The vaporisation took place in a large bell jar immersed in a thermostat, and provision was made for the stirring of the vaporising substance and for the circulation of the air and vapour in the bell jar. When the air in the bell jar had become saturated with the vaporising substance, it was aspirated over a column of hot lime. The amount of halogen in the lime was subsequently determined by Volhard's method. The vapour pressure of the bromine compound has been determined at various temperatures between 19.3° and 69.1°, the vapour pressures of the chlorine compound and of the isomorphous mixtures at 49.1°, at which temperature the vapour pressures of *p*-dichlorobenzene and *p*-dibromobenzene are 5.23 and 0.31 mm. mercury respectively. The curve exhibiting the variation of vapour pressure of the isomorphous mixtures with their composition does not deviate much from a straight line, although the mixtures with 0—60 per cent. chlorobenzene have a slightly greater vapour pressure, those with 60—100 per cent. chlorobenzene a slightly lower vapour pressure than that given by the straight line. The partial pressure curve for the chlorobenzene is regular, but that for the bromobenzene is peculiar, in that the vapour pressure of the bromobenzene in mixtures containing 57—100 per cent. of that compound is greater than that of the



pure bromobenzene. Mixtures of any composition between those limits should therefore separate gradually into pure dibromobenzene and the mixture with 57 per cent. This is a case of supersaturated solid solutions (compare Abstr., 1895, ii, 439), and these results are not in harmony with the earlier work (Küster and Würfel, this vol., ii, 80). Accordingly, fresh experiments have been made on the solubility of the isomorphous mixtures in aqueous alcohol at  $49.1^{\circ}$ , and it is found that the solubility of *p*-dibromobenzene from a 59 per cent. mixture is as great as that of the pure bromine compound itself, whilst the solubility of *p*-dibromobenzene from mixtures containing 80–90 per cent. of that compound is greater than that of the pure dibromobenzene. The consequent separation of a 92.5 per cent. mixture into pure *p*-dibromobenzene and the mixture with 57 per cent. of the bromine compound has been directly observed, at least in its initial stages.

J. C. P.

**Boiling Points of Homologous Compounds.** SYDNEY YOUNG (*Phil. Mag.*, 1905, [vi], 9, 1–19).—Since the time of Kopp, various expressions have been proposed for the boiling points of homologous series, notably (1) the formula  $T = aM^b$  due to Walker, in which  $T$  is the absolute boiling point,  $M$  the molecular weight, and  $a$  and  $b$  are constants; (2) that due to Ramage,  $T = a[M(1 - 2^{-u})]^{\frac{1}{2}}$ , where  $u$  is the number of carbon atoms in the molecule. The author considers that the rise of boiling point for an increment of  $\text{CH}_2$  may be usefully regarded as being mainly a function of the absolute temperature, and adopts provisionally the formula  $\Delta = 144.86/T^{0.0148\sqrt{T}}$ , which was derived for the homologous paraffins. It is shown that for these compounds the agreement between calculated and observed values is better than that obtained by Ramage's formula. The formula was applied also to halogen compounds, ethers, amines, aldehydes, esters, alcohols, acids, cyanides, ketones, and nitro-compounds, care being taken only to accept the values for the boiling points for which accuracy could be expected. From the data as a whole, he considers the formula gives errors rarely exceeding  $1.5^{\circ}$ , and generally less than  $1^{\circ}$  if the compounds contain one or more  $\text{C}-\text{CH}_2-\text{C}$  groups and are not associated. The accord is better for iso-compounds than for normal, and holds fairly well in associated compounds if their molecular weight is sufficiently high. The values are too high for associated compounds and for the lowest members of the series (*Trans.*, 1903, 83, 68).

L. M. J.

**Theory of the Heat of Combustion and the Heat of Formation of Hydrocarbons in the Gaseous State.** JULIUS THOMSON (*J. pr. Chem.*, 1905, [ii], 71, 164–181).—A reply to Lagerlöf (*Abstr.*, 1904, ii, 382, 605; this vol., ii, 76).

G. Y.

**Certain Heats of Dilution.** JOSEPH E. TREVOR (*J. Physical Chem.*, 1905, 9, 90–109).—A mathematical paper in which the author investigates by the method of the thermodynamic potential the heats of irreversible dilution of a two component one phase system.

L. M. J.

**Pycnometer for Small Quantities (0.1—0.5 gram) of Solid Substances.** JULES JACOBSEN (*Chem. Centr.*, 1905, i, 489; from *Bull. Soc. chim. Belg.*, 1904, 18, 198—200).—The pycnometer has the form of a small bottle of 2—3 c.c. capacity, and is provided with two necks. One of these, 12 cm. long and 1—1.5 mm. in diameter, is divided into 100 parts of a total volume of 0.1 c.c. The second neck, about 5 mm. in diameter, is provided at its extremity with a copper tube, through which a well-fitting screw-stopper works; by means of this, the level of the liquid in the wider neck is always brought to a definite point.

The apparatus is filled with a suitable liquid and the level read off in the capillary neck; a weighed quantity of the substance is then introduced through the wider tube, and after adjustment of the end of the liquid column to the mark by means of the screw stopper, the level in the capillary is again read off. The difference in the two readings represents the volume of the solid substance introduced (compare MacKenna, *Abstr.*, 1899, ii, 467).

H. M. D.

**Density Determinations with a Pipette. Adjustment of Titrimetric Solutions by Volume Weight.** FRIEDRICH W. KÜSTER and SIEGMAR MÜNCH (*Zeit. anorg. Chem.*, 1905, 43, 373—383).—The estimation of the weight of a given volume of an aqueous solution by means of a float of 10 c.c. is accurate to the extent of at least  $\pm 0.0001$  without any special precautions being taken and where only one determination is made. The same extent of accuracy may be attained by comparison of the weights of water and of solution respectively which an ordinary 100 c.c. pipette delivers at a given temperature. The accuracy of the measurement of volume by a 100 c.c. pipette may be  $\pm 0.00005$ , if the neck of the pipette be chosen sufficiently narrow.

Density determinations with a pipette are sufficient for the preparation of normal solutions. Figures are quoted where the accuracy of the method is indicated in the case of the preparation of standard solutions of hydrochloric acid.

A. McK.

**Compressibility of Gases between One Atmosphere and Half an Atmosphere of Pressure.** LORD RAYLEIGH (*Proc. Roy. Soc.*, 1905, 74, 446. Compare *Abstr.*, 1903, ii, 313).—The quotient of the value of  $pv$  at half an atmosphere by the value at one atmosphere is given for various gases at specified temperatures. The numbers differ slightly from those given in the preliminary communication.

	Oxygen.	Hydrogen.	Nitrogen.	Carbon monoxide.	Air.	Carbon dioxide.	Nitrous oxide.
Temp. ..	11.2°	10.7°	14.9°	13.8°	11.4°	15.0°	11.0°
	1.00038	0.99974	1.00015	1.00026	1.00023	1.00279	1.00327

The compressibilities at 0° are calculated, and from these the ratios of the densities as they would be observed at 0° and under very low pressures are deduced.

From the densities of oxygen and nitrogen, the atomic weight of nitrogen = 14.008 (O = 16). From the densities of oxygen and nitrous oxide, N = 13.998.

H. M. D.

**Surface Tensions of some Organic Liquids.** JULES BOLLE and PHILIPPE A. GUYE (*J. Chim. phys.*, 1905, 38—49).—The values for the surface tension contained in the paper were obtained in the course of experiments on the weights of drops and the surface tension (Abstr., 1901, ii, 374). The temperatures range from the ordinary temperature to about 150°, and the compounds for which the values are given are phenol, *o*-cresol, *m*-cresol, quinoline, butylthiocarbimide, and phenylthiocarbimide. The results indicate association in quinoline at the lower temperatures, whilst abnormal changes of complexity with temperature were observed in the case of *m*-cresol. During the course of the work, a number of densities at various temperatures were determined, the compounds being cymene, amyl acetate, ethyl oxalate, *o*-cresol, *m*-cresol, benzophenone, anethole, methylpropylketoxime, quinoline, butylthiocarbimide, and phenylthiocarbimide.

L. M. J.

**Diffusion of Hydrogen through Palladium.** OWEN W. RICHARDSON (*Proc. Camb. Phil. Soc.*, 1905, 13, 27—32).—The experimental data obtained by Schmidt (Abstr., 1904, ii, 312) for the rate of diffusion of hydrogen through palladium, are applied to the author's formula for the rate of diffusion with the view of testing whether the diffusion takes place through the metal by means of hydrogen atoms or whether the assumption of molecular dissociation into atoms of hydrogen is unnecessary. The calculated results are not decisive, and the author shows that the differences of pressure employed in the diffusion experiments are not large enough to settle the question. On the assumption of dissociation and by making use of the temperature variation of the rate of diffusion, the heat absorbed in the dissociation of one gram-molecule of hydrogen within the metal is calculated to be  $10.88 \times 10^{-3}$  cal. More accurate experiments are required before the question of the condition of the diffusing hydrogen can be definitely settled.

H. M. D.

**Rôle of Diffusion during Catalysis by Colloidal Metals and Similar Substances.** HENRY J. S. SAND (*Proc. Roy. Soc.*, 1905, 74, 356—369).—A critical discussion of Nernst's theory of reaction velocity in heterogeneous systems (see Nernst, Abstr., 1904, ii, 315; also Bodenstein, *ibid.*, 245; Brunner, *ibid.*, 315) in the light of the experimental data supplied by Bredig and others (see Bredig and von Berneck, Abstr., 1900, ii, 213; Bredig and Ikeda, Abstr., 1901, ii, 441; Bredig and Reinders, *ibid.*, 442; Senter, this vol., i, 107). The author contends that the variation of the reaction velocity (1) with the concentration of the catalyser, (2) with the temperature, cannot be reconciled with Nernst's conception of a heterogeneous reaction unless the part played by convection is taken into account. On the basis of Nernst's hypothesis, a formula is deduced for the reaction velocity corresponding with a minimum amount of convection, and it is shown that the velocity constant thus calculated is greater than the experimental values found by Bredig, whereas the reverse ought to be the case. In other words, Bredig's reaction proceeds far too slowly to be reconciled with Nernst's hypothesis. If, however, the assumption that



equilibrium is permanently maintained on the boundary between the particles and the solution is abandoned, and it is assumed instead that the reaction velocity at the surface of the particles is proportional to the concentration of the solution in immediate contact with them, it is possible to deduce a formula which corresponds with the experimentally determined course of the reaction.

J. C. P.

**Some Phenomena which can occur in the case of Partial Miscibility of Two Liquids, one of them being Anomalous, Especially Water.** JOHANNES J. VAN LAAR (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 7, 517—531).—A theoretical paper.

J. C. P.

**Contribution to the Theory of Solution.** GEOFFREY MARTIN (*J. Physical Chem.*, 1905, 9, 149—155).—As the molecules of a liquid are in motion, the sphere of molecular activity may be taken as the distance beyond which one molecule does not cause appreciable curvative of the path of a second molecule. Owing to increase of velocity, this decreases with temperature, inasmuch as the force one molecule must exert on the other is increased. If a molecule of a second substance is present in solution, then, if the attraction of the liquid molecules on each other is greater than on this, the liquid will be drawn away from around it and it will possess greater freedom of movement. If, on the contrary, this attraction is less, the molecule will unite with liquid molecules until a new molecule is formed for which the previous case obtains. Owing to the same drawing away of the water molecules from around the solute molecules, if the distance between the latter is sufficiently small, they will draw together and separate from the solution, that is, solubility is limited, but increases with temperature. Miscibility of two liquids is due to equality of the attractive forces, and the dissociation of many substances in solution is explained by the reduction of the pressure around the molecule as seen above.

L. M. J.

**Concentrated Solutions.** JOHANNES J. VAN LAAR (*Chem. Centr.*, 1905, i, 491; from *Chem. Weekblad*, 2, 1—16).—The author gives a warning against the danger of carrying the analogy between gases and dilute solutions too far. He considers that the osmotic pressure in the case of an isolated solution is purely a mathematical fiction. For the theoretical treatment of concentrated solutions, the introduction of osmotic pressure correction terms analogous to van der Waals' gas correction factors is not practicable; it is, however, possible to subject such solutions to mathematical treatment by making use of the conception of thermodynamic potential.

The conclusion drawn by Jones and Getman that the deviations from van't Hoff's theory of solutions exhibited by concentrated aqueous solutions are due to the formation of hydrates is severely criticised.

H. M. D.

**Phenomena Observed when the Plait Curve meets the Solubility Curve.** ANDREAS SMITS (*Zeit. physikal. Chem.*, 1905, 51, 193—221).—Largely theoretical. The experimental work

recorded in the paper has been already described (see Abstr., 1904, ii, 15).

J. C. P.

**Rate of Solution of Zinc.** ERICH BRUNNER (*Zeit. physikal. Chem.*, 1905, 51, 95—105. Compare Abstr., 1904, ii, 315; also Ericson-Aurén and Palu-aer, Abstr., 1902, ii, 64; 1903, ii, 718).—Zinc containing lead as impurity dissolves too slowly in hydrochloric acid to admit of the view that the acid is always exhausted at the surface of the metal. When pure electrolytic zinc dissolves in an iodine solution, the iodine concentration is practically zero at the surface of the metal, that is, the velocity of solution is determined by the rate of diffusion of the iodine; when the zinc contains lead as impurity, the rate of solution is lower, and falls off rapidly with the time. The author has studied also the rate of anodic solution of zinc in a millinormal solution of zinc salt, and finds that the concentration of the zinc ions at the anode is related to the polarisation in accordance with Nernst's formula; when, however, the zinc salt solution is stronger (up to centinormal), the concentration of the zinc ions is smaller than the formula requires. It has not been found possible to give a theory which interprets all the three solution processes referred to above.

J. C. P.

**Proof of the Formation of Complexes between Acids with the Help of the Laws of Isohydric Solutions.** ROBERT HOFMANN (*Zeit. physikal. Chem.*, 1905, 51, 59—64. Compare Abstr., 1904, ii, 10).—Iodic and sulphuric acids obey the laws of isohydric solutions exactly, and therefore do not form complexes in aqueous solution. Evidence, however, has been obtained of the formation of complexes between iodic and chromic acids, and also, although less definitely, between (1) sulphuric and phosphoric acids, and (2) hydrobromic and phosphoric acids.

J. C. P.

**Formation of Salts in Solution, especially in the Case of Substances Exhibiting Tautomerism (Pseudo-acids, Pseudo-bases).** II. JULIUS W. BRÜHL and HEINRICH SCHRÖDER (*Zeit. physikal. Chem.*, 1905, 51, 1—18. Compare Abstr., 1904, i, 646, 969; this vol., ii, 70).—Ethyl acetoacetate has been mixed with the equivalent quantity of sodium ethoxide in alcoholic solution, and the spectrochemical constants of the various constituents have been determined before and after mixture. The comparison of these, with the aid of Biot and Arago's mixture law, shows that immediate and complete enolisation takes place on mixing. Further, the alteration of the spectrochemical constants, which is the evidence of enolisation, cannot be attributed to the formation merely of any additive compound of the ester and the sodium ethoxide.

J. C. P.

**Condition of a Chemical Reaction forming a Monovariant System.** CAMILLE MATIGNON (*Compt. rend.*, 1905, 140, 512—515).—A monovariant system of  $n + n' - 1$  components, one gaseous, the rest solid, is capable of forming a reversible reaction if  $Q > L + S$ , where  $Q$  is the heat developed during the direct reaction at the temperature  $T$  when the dissociation pressure is 760 mm. and  $L$  and  $S$

the molecular heats of fusion and volatilisation respectively of the gaseous substance. Thus, the reaction  $2\text{BaO sol.} + \text{O}_2 \text{ gas} \rightleftharpoons 2\text{BaO}_2 \text{ sol.} + 24.1 \text{ Cal.}$  is reversible at  $480^\circ$ , because for oxygen  $L + S = 2.7 \text{ Cal.}$ , and the temperature at which the dissociation pressure is 760 mm. is  $24100/32 = 753^\circ \text{ abs. or } 480^\circ \text{ C.}$ ; similarly, the reaction  $\text{Na}_2\text{SO}_4 \text{ sol.} + \text{HCl gas} \rightleftharpoons \text{NaHSO}_4 \text{ sol.} + \text{NaCl sol.} + 16.9 \text{ Cal.}$  is reversible at  $255^\circ$ , because for HCl  $L + S = 5.7 \text{ Cal.}$ , and the temperature at which the dissociation pressure is atmospheric is  $16900/30 = 528^\circ \text{ abs. or } 255^\circ \text{ C.}$

M. A. W.

**Cause of the Period of Chemical Induction in the Union of Hydrogen and Chlorine.** DAVID L. CHAPMAN and CHARLES H. BURGESS (*Proc. Roy. Soc.*, 1905, **74**, 400. Compare Bevan, *Abstr.*, 1904, ii, 21; 1902, ii, 237; Mellor, *Trans.*, 1902, **82**, 1280 and 1292; 1901, **79**, 216).—The view that the period of induction is due to the preliminary formation of an unstable intermediate compound is not in accord with the experimental observations recorded by the authors. The phenomenon is due to the presence in the gas (or in the aqueous solution in contact with it) of substances capable of reacting with chlorine. The retardation of chemical action does not depend on the condition of the hydrogen. Water and aqueous solutions possess the power of rendering active chlorine inactive towards hydrogen. On long contact with chlorine in the presence of light or on boiling with chlorine, these solutions lose this property. The only way in which the solutions recover the power of rendering active chlorine inactive is by the introduction of substances which react with chlorine. Of such substances, ammonia is very effective even in minute quantities, and sulphur dioxide acts in a similar way. An active mixture of hydrogen and chlorine does not become inactive when kept for several hours in the dark. Such a mixture, after keeping for several days in the dark, showed no signs of an induction period.

H. M. D.

**Union of Hydrogen and Oxygen at Low Pressures through the Passage of Electricity.** P. J. KIRKBY (*Phil. Mag.*, 1905, [vi], **9**, 171—185).—The author has previously shown that when a luminous discharge passes through hydrogen and oxygen in equivalent proportions at low pressures, partial union occurs (*Phil. Mag.*, Feb. 1904). If  $\Delta p$  mm. is fall of pressure associated with the passage of  $\Delta Q$  coulombs at pressure  $p$  mm. and potential difference  $X$ , then  $1/p \cdot \Delta p \cdot \Delta Q$  is a function of  $X/p$ . The experiments are continued, and it is seen that  $\Delta p/\Delta Q$  is independent of the distance between the plates and that the function is approximately linear, the curve being a straight line,  $\Delta p/p \cdot D \cdot \Delta Q = 1/10 + 3X/800pD$ , where  $D$  is the distance between the plates. If  $W$  is the number of molecules of water vapour connected with the passage to the electrode of each pair of ions, it is shown that  $W = 4\Delta p/\Delta Q$ , and hence  $W = 4(pD/100 + 3X/800)$ , and the probable physical interpretation of this result is given.

L. M. J.

**Reaction Velocity and Free Energy.** ERICH BRUNNER (*Zeit. physikal. Chem.*, 1905, **51**, 106—107).—There is no ground for supposing that, if it were possible to remove entirely the products of a reaction in a homogeneous system, the initial velocity of such a reaction would be infinitely great.

J. C. P.



**Decomposition of Ammonium Nitrite.** ARTHUR A. BLANCHARD (*Zeit. physikal. Chem.*, 1905, **51**, 117—122. Compare Abstr., 1903, ii, 18).—A reply to Arndt's criticism (Abstr., 1904, ii, 16).

J. C. P.

**Velocity of Change in Catalytic Reactions.** CARL KULLGREN (*Zeit. physikal. Chem.*, 1905, **51**, 108—116).—A reply to Euler's criticism (Abstr., 1904, ii, 318) of the author's work (Abstr., 1903, ii, 535).

J. C. P.

**The System Pyridine and Methyl Iodide.** A. H. W. ATEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1904, **7**, 468—470).—Pyridine methiodide is rapidly formed at temperatures higher than 60° from mixtures of pyridine and methyl iodide. The formation of pyridine methiodide at low temperatures has been examined; the results are represented by curves. The solid compound exists in a metastable form. It is shown that the two liquids, pyridine and methyl iodide, which are miscible in all proportions, may yield two sets of co-existing liquids owing to the formation of a chemical compound. The sharp intersection of the melting point lines at 117° and the elevation of the boiling point after the combination, pyridine boiling at 116°, methyl iodide at 42°, and the mixture at 270°, show that even in the liquid state the compound is certainly for the greater part undissociated.

A. McK.

**Action of Enzymes, Toxins, Antitoxins, and Agglutinins.** VICTOR HENRI (*Zeit. physikal. Chem.*, 1905, **51**, 19—32).—An unfavourable criticism of the work of Barendrecht (Abstr., 1904, ii, 551, 719), Herzog (Abstr., 1904, ii, 164, 506), and Visser. The author outlines the basis on which he considers any theory of enzyme action must be founded. Solutions of enzymes, toxins, &c., are regarded as two phase systems, the colloidal phase consisting of ultramicroscopic particles and holding a large quantity of water. When a dissolved substance is distributed between the water phase and the colloid phase, it is necessary to distinguish between the part which is irreversibly absorbed by the colloid and the part which is reversibly distributed between the two phases. In some cases, as, for example, with invertase, emulsin, and maltase, the amount of dissolved substance irreversibly absorbed by the colloid appears to be negligibly small. As the concentration of the dissolved substance (for example, sucrose) in the water phase increases, the concentration in the colloidal phase increases also, but more slowly, and from a certain point onwards is practically constant. This influence of concentration on the adsorption is very similar to the influence of concentration on the rate of inversion of sucrose by invertase, so that the law of partition of a dissolved substance between a colloid and water and the rate at which the partition takes place have an important bearing on the velocity of any reaction induced by the colloid.

J. C. P.

**Isodimorphism.** FRÉDÉRIC WALLERANT (*Compt. rend.*, 1905, **140**, 447—449).—Two substances, which are not isomorphous in their

stable, crystalline forms, are capable of forming mixed crystals in which the stable form of one compound preponderates, the other being present in an unstable, isomorphous form; thus, if *Ab* represent the biaxial modification of one component and *Cu* the uniaxial modification of the other, then a certain number of cases of isodimorphism are known in which mixed crystals of the type *Ab,Cb* or *Cu,Au* are formed; up to the present, however, the series has not been extended to include mixed crystals of the type *Ab,Cu* or *Au,Cb*. In the present paper, the author describes three types of mixed crystals formed by potassium and rubidium nitrates; the first two, namely, *Ab,Cb* and *Ab,Cu* are obtained by crystallising from water the salts mixed in varying proportions, whilst the third type, *Au,Cu*, is obtained by fusing a mixture of the salts in which rubidium nitrate preponderates. M. A. W.

**Calculation of Atomic Weights.** JULIUS MEYER (*Zeit. anorg. Chem.*, 1905, 43, 242—250).—The various errors introduced during the calculation of atomic weights are considered. A. McK.

**Molecular Weight Determinations by means of Platinum Thermometers.** HOWARD T. BARNES, EBENEZER H. ARCHIBALD, and DOUGLAS MCINTOSH (*J. Amer. Chem. Soc.*, 1905, 27, 47—49).—A description is given of apparatus involving the use of platinum thermometers which has been devised for ebullioscopic determinations, a differential method of temperature measurement being employed. The apparatus is said to be superior to that in which mercury thermometers are used, since there is no necessity either for adjustment for liquids having different boiling points or for any tapping device. No error can be introduced by changes in the atmospheric pressure and the thermometer can be made of any degree of sensitiveness. A diagram of the apparatus is given.

The results of some determinations of the molecular weights of potassium chloride, nitrate and sulphate in aqueous solutions are appended. E. G.

**Efficiency of Centrifugal Purification.** THEODORE W. RICHARDS (*J. Amer. Chem. Soc.*, 1905, 27, 104—111).—Quantitative experiments are described which show that the purification of crystals can be effected with a considerable saving of time, labour, and material by means of centrifugal draining and washing. It is shown, for example, in the case of sodium nitrate containing free nitric acid as an impurity that with two crystallisations the salt obtained with the aid of centrifugal draining and washing is 2000 times as pure as that obtained by ordinary gravitational draining, and that for the attainment of an equal degree of purity the yield is about 100 times as great by the centrifugal process as by the ordinary method of draining.

Special forms of apparatus have been devised for the manipulation of small quantities of material. For an account of these, the description and diagrams in the original must be consulted. E. G.

**Electric Furnaces for Laboratory Use.** BERTRAM BLOUNT (*Analyst*, 1905, 30, 29—35).—The first combustion furnace described

is one in which a porcelain tube of  $\frac{3}{4}$  inch diameter is placed inside a shorter and wider fireclay tube of about 1 inch internal diameter, so that about 3 inches of the inner tube project at each end. The space between the two tubes is filled with resistance material, consisting of retort carbon mixed with varying quantities of siloxicon or carborundum. Two short copper tubes fitting closely into the space between the tubes at both ends serve to conduct the current to the resistance material.

In the second furnace, two concentric fireclay tubes surround, but do not touch, that part of the porcelain tube to be heated. The resistance material is packed between these fireclay tubes and the current led in by means of an annular copper disc at each end. If the space between the tubes be very narrow, retort carbon may be used alone; otherwise, the resistance must be increased by adding varying amounts of siloxicon. The two tubes are surrounded by two other wider fireclay tubes, which in turn are wrapped with asbestos to retain the heat. The ends of the furnace are made of uralite discs, which also support the porcelain tube.

For ultimate organic analyses, the furnace can be made in sections, to allow for progressive heating. W. P. S.

#### Apparatus for Preparing Hydrogen or Carbon Dioxide.

MAX ÜBEL (*Chem. Zeit.*, 1905, 29, 141).—An apparatus constructed on the Debray principle, for the details of which the original must be consulted. L. DE K.

## Inorganic Chemistry.

**Action of Persulphates on Haloids.** MAX DITTRICH and H. BOLLENBACH (*Ber.*, 1905, 38, 747—751. Compare Abstr., 1904, ii, 80; Marshall, Abstr., 1901, ii, 156).—Silver chloride, bromide, and iodide, are not acted on by ammonium persulphate in warm dilute nitric acid solution, but, if a small quantity of silver nitrate is present, the silver haloid is partly oxidised to chlorate, bromate, or iodate respectively. The oxidation takes place most easily with the iodide, and, if the warming is continued, may be in that case complete.

G. Y.

**Chemical and Geological History of the Atmosphere.** JOHN STEVENSON (*Phil. Mag.*, 1905, [vi], 9, 88—102).—A continuation of previous papers (*ibid.*, 1900, [v], 50, 312, 399; 1902, [vi], 4, 435), in which the conclusion was arrived at that in earlier geological history the atmosphere was far more extensive, contained no free oxygen, but contained very much more carbon dioxide as well as, probably, hydrogen and hydrocarbons. The quantity of carbon dioxide diminished in early geological epochs by vegetation and weathering of rocks, and



the author considers that, after a certain point in this abstracting process was reached, the quantity of carbon dioxide in the atmosphere probably became variable, that is, alternately increased or diminished according to the relative activity of the forces or reactions which produced it and the counteracting forces or reactions. The various productive and removing agencies are considered and the author shows how slight variations in volcanic activity and other telluric phenomena may affect the quantity of carbon dioxide. Lecher considered that carbon dioxide and not aqueous vapour is the chief cause of the absorption of solar radiation in our atmosphere (Abstr., 1881, 489), and from this the author elaborates the idea that the variations in the quantity of carbon dioxide in the atmosphere are sufficient to account for, and were probably the cause of, the great differences of climatic conditions during geological history.

L. M. J.

**Formula of Hyposulphurous Acid.** AUGUST BERNTHSEN (*Ber.*, 1905, 38, 1048—1056).—The formula of hyposulphurous acid is discussed in connection with the recent work of Baumann, Thesmar, and Frossard on formaldehyde sodium hyposulphite (this vol., i, 260), who claim that the constitution  $\text{H}_2\text{S}_2\text{O}_4$  was not established by the controversy between Bernthsen and Schützenberger (Abstr., 1882, 461).

It is here claimed that sodium hyposulphite is a chemical individual,  $\text{Na}_2\text{S}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , and not a double salt,  $\text{NaHSO}_3 \cdot \text{NaHSO}_2 \cdot \text{H}_2\text{O}$ ; that the terms hyposulphite and hyposulphurous acid are already in use for compounds of the type  $\text{R}_2'\text{S}_2\text{O}_4$ , and, therefore, not available for naming other compounds, and, lastly, that compounds of the type  $\text{R}'\text{HSO}_2$  or  $\text{R}_2'\text{SO}_2$ , are best termed salts of sulphylic acid, the formaldehydesulphoxylates being already known.

E. F. A.

**Hyposulphurous Acid.** MAX BAZLEN (*Ber.*, 1905, 38, 1057—1068. Compare preceding abstract).—Hyposulphite solutions are technically prepared by the action of zinc on aqueous sodium hydrogen sulphite solutions and subsequent removal of the zinc with milk of lime or sodium hydroxide. Sodium hyposulphite is precipitated from this either by sodium chloride or hydrogen sulphite or by alcohol; it crystallises in glistening prisms of the formula  $\text{Na}_2\text{S}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ . The potassium salt,  $\text{K}_4\text{S}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ , prepared in the same way from potassium hydrogen sulphite, sulphurous acid, and zinc, forms sulphur-yellow needles. The calcium salt,  $\text{CaS}_2\text{O}_4 \cdot 1\frac{1}{2}\text{H}_2\text{O}$ , is best prepared by the interaction of sodium hyposulphite and calcium chloride under the exclusion of air; it separates in minute, sparingly soluble needles. The zinc salt is easily soluble; zinc double salts, as for example,  $\text{ZnNa}_2(\text{S}_2\text{O}_4)_2$ , are readily formed but not very characteristic. To dehydrate the foregoing salts, the well-stirred suspension in dry alcohol is heated at from 65—70°; technically an alcoholic paste of the salt is extracted in a Soxhlet apparatus with boiling alcohol, which is continually dried by quicklime.

Very stable sodium, potassium, calcium, and zinc salts of the type  $\text{R}_2'\text{S}_2\text{O}_4$  are thus obtained.

*Sodium formaldehydesulphoxylate*,  $\text{NaSCO}_3\text{H}_3 \cdot 2\text{H}_2\text{O}$ , obtained by the

interaction of sodium hyposulphite, formaldehyde and sodium hydroxide, crystallises from water in prisms or from hot alcohol in silver, glistening leaflets. With barium hydroxide, it forms a precipitate of a *barium* salt,  $\text{BaSCO}_4\text{H}_4\text{H}_2\text{O}$ , crystallising in needles grouped in stellar aggregates. *Sodium benzaldehydesulphoxylate*,  $\text{NaSO}_3\text{C}_6\text{H}_7$ , forms large, glistening crystals sparingly soluble in water. E. F. A.

**Time Interval before Precipitation is observed in Thio-sulphate Solutions.** GASTON GAILLARD (*Compt. rend.*, 1905, 140, 652—655. Compare von Oettingen, *Abstr.*, 1900, ii, 400).—Curves are given showing the influence of the concentration of the sodium thiosulphate and of the added acid on the time which elapses before the separation of sulphur is observed. Various acids and thiosulphates have been examined. The presence of salts (chlorides, bromides, iodides, sulphites) in the thiosulphate solutions retards the appearance of the opalescence. On addition of equal volumes of water, glycerol, and alcohol to the same volume of 5 per cent. sodium thiosulphate solution, the observed retardations are different, the greatest effect being produced by the alcohol, the least by the water. H. M. D.

**Action of Hydrogen Sulphide on Selenious Acid. II. Selenium Sulphide.** ALEXANDER GUTBIER and JOHANN LOHMANN (*Zeit. anorg. Chem.*, 1905, 43, 384—409. Compare this vol., ii, 84).—The authors have investigated the question as to whether the products obtained by the action of hydrogen sulphide on selenious acid or by the action of hydrogen selenide on sulphurous acid are mixtures or compounds of selenium and sulphur.

The orange-red product prepared by the action of hydrogen sulphide on an aqueous solution of selenious acid in the absence of air and of light contained 58.1 per cent. of selenium and 41.8 per cent. of sulphur, whilst the product obtained under pressure contained 17.63 per cent. of selenium and 82.27 per cent. of sulphur, whereas  $\text{SeS}_2$  requires  $\text{Se} = 55.23$  and  $\text{S} = 44.77$  per cent. At the ordinary temperature, in the presence of air, a product is obtained which, when heated, becomes red and has the formula  $\text{SeS}_2$ ; at higher temperatures, a product richer in selenium is obtained and at lower temperatures the product contains more sulphur than selenium. These results indicate that a compound is not formed. At the ordinary temperature, hydrogen sulphide acts as a reducing agent according to the equation  $\text{H}_2\text{SeO}_3 + 2\text{H}_2\text{S} = \text{Se} + \text{S}_2 + 3\text{H}_2\text{O}$ . At higher temperatures, the liberated sulphur is oxidised to sulphur trioxide.

From the mixture obtained by the action of hydrogen sulphide on selenious acid, the sulphur can be mechanically separated by extraction with a mixture of benzene and carbon disulphide.

The results are comparable with those of Gutbier and Flury on the reduction of tellurous acid by hydrogen sulphide (*Abstr.*, 1903, ii, 71).

The authors have not been able to isolate the sulphide,  $\text{SeS}$ , described by Ditté.

The hydrosol obtained by passing hydrogen sulphide into an aqueous solution of selenium dioxide also does not contain selenium

and sulphur chemically combined, since, when the solution is repeatedly agitated with carbon disulphide, the total amount of sulphur present can be separated.  
A. McK.

**Electrochemical Equivalent of Tellurium.** GINO GALLO (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 23—28 and 104—109. Compare Abstr., 1904, ii, 639).—The voltameter employed by the author was tested by electrolysing copper sulphate solution in series with a silver voltameter, the values obtained for the atomic weight of copper varying from 63·50—63·66, the mean being 63·58. The electrolytic deposition of tellurium was carried out in series with two silver voltameters; as a mean of 12 determinations, the number 127·61 was obtained for the atomic weight of tellurium ( $\text{Ag} = 107·93$ ).  
T. H. P.

**Electrolytic Oxidation of Ammonia to Nitrites.** ERICH MÜLLER and FRITZ SPITZER (*Ber.*, 1905, 38, 778—782. Compare Traube and Biltz, Abstr., 1904, ii, 727).—In the presence of a small amount of sodium hydroxide, ammonia may be oxidised electrolytically to nitrite even in the absence of copper compounds.

In the presence of copper hydroxide and sufficient alkali, the oxidation of ammonia to nitrite does not cease suddenly when the nitrite concentration has reached a certain value, but appears to proceed quite independently of the nitrite concentration. In these experiments, the oxidation was allowed to proceed for a comparatively short time only, so that the amount of alkali present was not greatly reduced. The formation of nitrite is intimately connected with the amount of alkali present, and when no sodium hydroxide is present, but only ammonia, nitrite, and copper hydroxide, it is found that the nitrite is transformed into nitrate more rapidly than the ammonia into nitrite, and thus the concentration of the nitrite tends to decrease.

Nitrogen is also formed during the oxidation.

J. J. S.

**Electrolytic Oxidation of Ammonia.** WILHELM TRAUBE and A. SCHÖNEWALD (*Ber.*, 1905, 38, 828—831. Compare Abstr., 1904, ii, 727).—In continuation of the previous experiments, the influence of changing the concentration of the free alkali or ammonia on the rate of the electrolytic oxidation of ammonia has been investigated. In presence of much ammonia, the amount of nitrite can be increased to about 11 per cent. before oxidation to nitrate begins, whilst from an 11 per cent. nitrite solution to which ammonia, sodium hydroxide, and copper hydroxide had been added a solution containing as much as 17 per cent. nitrite was obtained on hydrolysis. The paper includes a claim for priority (compare Müller and Spitzer, preceding abstract).

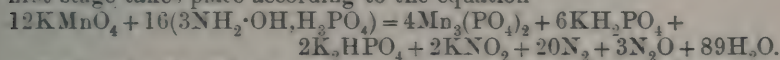
E. F. A.

**Action of Potassium Permanganate on the Salts of Hydroxylamine (Nitrate, Phosphate, Arsenate).** LOUIS J. SIMON (*Compt. rend.*, 1905, 140, 659—661).—When decinormal potassium permanganate is added to a neutral solution of hydroxylamine nitrate until the solution assumes a yellow tint, it is found that 0·4 molecules of the permanganate are required for each molecule of hydroxyl-



amine in accordance with the equation  $2\text{KMnO}_4 + 5(\text{NH}_2\cdot\text{OH}\cdot\text{HNO}_3) = 2\text{Mn}(\text{NO}_3)_2 + 2\text{KNO}_2 + 2\text{N}_2\text{O} + 10\text{H}_2\text{O}$ . If the solution is acidified at this stage, the nitrite is oxidised and a further quantity of permanganate equal to 0.16 molecule for each molecule of hydroxylamine can be added to the solution before the latter assumes the pink colour of the permanganate. When hydroxylamine chloride or sulphate is employed instead of the nitrate, only one-half of the above quantity of permanganate is used up in the second stage.

When the phosphate or arsenate is employed, the oxidation in the first stage takes place according to the equation



Each molecule of hydroxylamine requires 0.25 molecule of permanganate. If the solution is acidified at this stage, a further 0.166 molecule of permanganate is reduced per molecule of hydroxylamine.

If the hydroxylamine solutions are acidified at the outset, the reducing power is increased. The molecular ratio permanganate | hydroxylamine is not quite constant, but oscillates around the value 0.8. If the acidity is too feeble or too strong, the maximum reducing power is not attained. The value of the reducing power depends also to some extent on the temperature and on the rapidity of titration. It is evident, therefore, that hydroxylamine cannot be accurately estimated by direct titration with permanganate in acid solution. H. M. D.

**Nitroxyl Chloride.** ALEXANDER GUTBIER and JULIUS LOHMANN (*J. pr. Chem.*, 1905, [ii], 71, 182—195).—The authors confirm the statements of Williams (*Trans.*, 1886, 49, 222) that nitroxyl chloride is not formed by the action of chlorine on nitrogen peroxide, and of Geuther (*Abstr.*, 1888, 785) that the product of the action of nitrogen peroxide on phosphoric oxide is nitrosyl chloride. As no chlorinated product could be obtained by acting on silver nitrate with chlorine (Odet and Vignon, *Compt. rend.*, 1869, 69, 1142), nitroxyl chloride has not yet been prepared. G. Y.

**Attempts to Prepare Absolute Nitric Acid.** FRIEDRICH W. KUSTER and SIEGMAR MÜNCH (*Zeit. anorg. Chem.*, 1905, 43, 350—355).—Nitric acid containing 98.5 per cent. of  $\text{HNO}_3$  was partially frozen, the liquid removed, and the almost pure nitric acid thus obtained fractionated by crystallisation in an apparatus described. By continued fractionation, products were soon obtained of constant freezing point, that is, the temperatures at which successive fractions began to crystallise were constant. As solidification, however, proceeded, the temperature fell appreciably, and this indicated that an impurity was present which could not be removed by fractional crystallisation. The acid obtained in this manner contained  $99.4 \pm 0.1$  per cent. of  $\text{HNO}_3$ .

Absolute nitric acid exists only in the form of snow-white crystals at a temperature below  $-41^\circ$ . Nitric acid crystals melt to a yellow liquid, which is a solution of nitrogen pentoxide and water in nitric acid. Whilst solid nitrogen pentoxide is colourless, the liquid has not

yet been obtained colourless. This liquid, in presence of dry air, becomes colourless, the pentoxide being removed and the water remaining. The liquid obtained after removal of the pentoxide contained 98·67 per cent. of  $\text{HNO}_3$ .

When dry air was passed into an acid containing 99·4 per cent. of  $\text{HNO}_3$ , the yellow colour of the acid disappeared exactly at the point when the percentage of  $\text{HNO}_3$  was 98·67. A. McK.

**The Phosphorescence of Phosphorus.** ÉMILE JUNGFLIECH (*Compt. rend.*, 1905, 140, 444—447).—The phosphorescence of phosphorus is commonly attributed to the combustion of phosphorus vapour; the author, however, finds (1) that the tension of phosphorus vapour at the ordinary temperature is too low to account by its combustion for the relatively intense luminosity of the phosphorescence, (2) that phosphorus in contact with even small quantities of oxygen is converted into an oxide much more volatile than phosphorus, which by its spontaneous combustion gives rise to the luminous phenomenon of phosphorescence. The investigation on the nature of the lower oxide is not yet complete, and the present paper contains a description of experiments which establish the two points stated above. A current of dry carbon dioxide freed from traces of oxygen by contact with heated copper, and then saturated with phosphorus vapour at  $15^\circ$  by passing over pure dry phosphorus, becomes only very faintly luminous when it comes in contact with the air, and the amount of phosphorus present as vapour in one litre of the gas at  $15^\circ$ , and under normal pressure is 0·000535 gram; if, however, a very small quantity of air be mixed with the carbon dioxide before it passes over the phosphorus, the issuing gas becomes intensely luminous in contact with the air, than which also it is specifically heavier; the phosphorescent oxide is partly condensed when cooled at  $-10^\circ$ , the condensing tube containing in addition a small quantity of phosphoric oxide and of the oxide  $\text{P}_4\text{O}$  (compare, however, Burgess and Chapman, *Trans.*, 1901, 79, 1235).

M. A. W.

**Red Phosphorus.** RUDOLF SCHENCK (*Zeit. Elektrochem.*, 1905, 11, 117—118).—The name "red phosphorus" includes a large number of products the properties of which differ considerably from each other and depend on the temperature at which the substance has been prepared. Hittorf's red phosphorus, crystallised from lead, stands at one end of the series and is the only well defined member of it. When yellow phosphorus is heated, its vapour pressure remains constant until all the yellow phosphorus has disappeared; the vapour pressure does not then fall at once to that of red phosphorus, but diminishes quite gradually. This points to the product first obtained being a solution of yellow in red phosphorus. This view is supported by the behaviour of solutions of phosphorus. A solution of yellow phosphorus in phosphorus iodide deposits red phosphorus at  $100^\circ$ , a solution in  $\text{P}_4\text{S}_3$  at about  $300^\circ$ , and a solution in phosphorus tribromide at its boiling point. The red phosphorus so obtained is bright scarlet in colour, and it contains large quantities of the solvent. That deposited from phosphorus tribromide at  $30^\circ$  (by the action of light) contains

47.6 per cent. of the solvent, at  $140^{\circ}$ , 36.3 per cent., at  $185^{\circ}$ , 27.1 per cent., and at  $218^{\circ}$  23.6 per cent. It is amorphous. The red phosphorus first deposited from yellow phosphorus by heat alone closely resembles that obtained from solvents. Scarlet phosphorus is very readily oxidised; it phosphoresces in ozone, although not in air. It is turned deep black by ammonia, piperidine, and other primary and secondary amines, a solution of potassium hydroxide in aqueous alcohol dissolves it, yielding a deep red solution. From this solution, acids precipitate a yellow, solid hydride of phosphorus mixed with bright red, finely divided phosphorus. The yellow, solid hydride behaves in much the same way as scarlet phosphorus itself towards piperidine and alcoholic potash. Determinations of the depression of the freezing point of yellow phosphorus by dissolving the hydride in it showed that the molecule of the latter is  $P_{12}H_6$ .

When scarlet phosphorus is heated for a long time, it becomes more and more like the red phosphorus of commerce, its colour becomes deeper and its reactivity less. Scarlet phosphorus is therefore only very finely divided amorphous red phosphorus, related to ordinary red phosphorus in much the same way that precipitated silica is related to quartz glass.

T. E.

**Yellow and Red Arsenic Trisulphides.** HEINRICH WINTER (*Zeit. anorg. Chem.*, 1905, 43, 228—235).—A contribution to the study of colloids. To a colloidal solution of arsenic trisulphide in water, prepared by passing an excess of hydrogen sulphide into an aqueous solution of arsenic trioxide and then removing the hydrogen sulphide, ammonium chloride, sulphate, nitrate, acetate and carbonate were added respectively. After the precipitate obtained in each case had subsided, the supernatant liquid was free from arsenic. Analysis of each deposit showed that the arsenic trisulphide had been quantitatively separated from the colloidal solution. The rate of coagulation was most rapid with ammonium chloride and slowest with ammonium carbonate.

The red modification of arsenic trisulphide was obtained by freezing the yellow colloidal solution, when the solid red form separated along with ice. It may also be conveniently obtained by evaporating the colloidal solution on the water-bath. When yellow arsenic trisulphide, obtained by the addition of electrolytes to the colloidal solution, was heated in an air oven at  $100^{\circ}$ , it was transformed into a red, vitreous mass; the yellow arsenic trisulphide obtained by passing hydrogen sulphide into a solution of arsenic trioxide in hydrochloric acid does not, however, undergo a similar change at  $100^{\circ}$  unless it is completely freed from hydrochloric acid. The red form is gradually transformed into the yellow on exposure to the atmosphere for 5—6 weeks at the ordinary temperature, or by being heated for some time at  $150$ — $160^{\circ}$ .

Golden-yellow leaflets of arsenic trisulphide are formed in small amount when hydrogen sulphide is passed into an N5 solution of arsenic trioxide in water. The formation of this modification increases in amount with increase of concentration of arsenious acid up to 3.10N; as the concentration is still further increased, the



amount diminishes. Traces only are formed with *N*/20 solutions of arsenious acid. A. McK.

**The Perborates.** PETR G. MELIKOFF (*Compt. rend.*, 1905, 140, 502).—A claim for priority (compare Jaubert, this vol., ii, 26, Melikoff and Pissarjewsky, *Abstr.*, 1898, ii, 332, 374; 1899, ii, 298). M. A. W.

**Perborates.** J. BRUHAT and H. DUBOIS (*Compt. rend.*, 1905, 140, 506—509).—The perborates stable in the solid state are readily decomposed in aqueous or acid solution, liberating oxygen which, in the nascent state, combines with the water present to form hydrogen peroxide, hence the salts act as strong oxidising agents, liberating iodine from potassium iodide, oxidising chromic to perchromic or molybdic to permolybdic acid, ferrous to ferric salts, mercurous salts to yellow mercuric oxide, lead hydroxide to lead plumbate, and manganous salts to manganese dioxide; they also give an intense blood-red coloration with sulphuric acid solutions of titanous acid or sodium vanadate. *Uranyl perborate*,  $\text{UO}_4$ , is a yellow, stable compound obtained by the action of a perborate solution on uranium dioxide. *Potassium di-perborate*,  $\text{KB}_2\text{O}_5 \cdot 2\text{H}_2\text{O}$ , is precipitated by alcohol from a solution of potassium diborate in hydrogen peroxide, contains 18.06 per cent. of active oxygen, and loses  $\text{H}_2\text{O}$  in a vacuum over phosphoric anhydride. *Ammonium perborate*,  $\text{NH}_4\text{BO}_3 \cdot \text{H}_2\text{O}$ , contains 16.84 per cent. of active oxygen. Sodium perborate,  $\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$ , obtained by the electrolysis of a solution of sodium orthoborate or by adding hydrogen peroxide to the solution (compare, however, Melikoff, preceding abstract, and Jaubert, this vol., ii, 26) or by saturating a solution of boric acid with sodium peroxide, contains 10.38 per cent. of active oxygen, and on careful dehydration loses gradually  $4\text{H}_2\text{O}$ , the anhydrous salt,  $\text{NaBO}_3$ , containing 19.51 per cent. of active oxygen. M. A. W.

**Evolution of Carbon in Fuels.** ISIDORE BAY and JUST ALIX (*Compt. rend.*, 1905, 140, 377—378).—The authors find that the carbon content of fossil fuels increases with the age of the fuel, whilst the hydrogen and oxygen diminish, and the results obtained by analysing fuels in the various stages of formation between cellulose and graphite show that the percentage of carbon rises rapidly from 44.44 in cellulose to 74.46 in pit coal, 89.29 in anthracite, and 93.86 in graphite; the percentage of oxygen falls from 44.39 in cellulose to 28.03 in lignite and 9.03 in pit coal, and the percentage of hydrogen drops rapidly from 4.82 in pit coal to 3.28 in anthracite and 0.1 in graphite, whilst the amount of nitrogen which is absent in cellulose reaches a maximum in peat and then diminishes normally. The analytical numbers quoted in the paper are the mean results of three hundred analyses of each fuel obtained from different sources. M. A. W.

**Atomic Weight of Silicon.** W. BECKER and JULIUS MEYER (*Zeit. anorg. Chem.*, 1905, 43, 251—266).—An historical account of the

methods used in the determination of the atomic weight of silicon is given.

The authors employed silicon tetrachloride for their determinations. This boiled at  $56.9^{\circ}$  under 760 mm. pressure; its vapour pressure at various temperatures was determined, the results obtained being considerably lower than those of Thorpe (*Trans.*, 1880, **37**, 327). In the purification of silicon tetrachloride, special precautions were taken to exclude water; silicon tetrachloride, finally purified by means of liquid air, melts at  $-89^{\circ}$ . Glass bulbs filled with the tetrachloride were broken in a platinum crucible containing ice-cold water, the silicon being estimated as the dioxide. As a mean of eight experiments, the value  $\text{Si} = 28.21$  ( $\text{O} = 16$ ) was found. A. McK.

**The Carbon Silicide of the Cañon Diablo Meteorite.** HENRI MOISSAN (*Compt. rend.*, 1905, **140**, 405—406. Compare this vol., ii, 43).—From the residue obtained by extracting with hydrochloric acid 53 kilograms of the meteoric iron, a sufficient quantity of carbon silicide was separated to identify it with the synthetical compound  $\text{CSi}$  already described (compare *Abstr.*, 1894, ii, 43). The meteoric compound forms hexagonal crystals of a green colour, the sp. gr., determined in a mixture of bromoform and methylene iodide, is between 3 and  $3.2$ , and it behaves towards such reagents as fused potassium nitrate, chlorate, or hydroxide, fused lead chromate, or the acids exactly in the same way as the synthetical compound. M. A. W.

**Solubility of Lithium Carbonate in Solutions of Salts of the Alkali Metals.** GUSTAV GEFFCKEN (*Zeit. anorg. Chem.*, 1905, **43**, 197—201).—The solubility of lithium carbonate in aqueous solutions of potassium nitrate, potassium chloride, sodium chloride, potassium sulphate, potassium chlorate, sodium sulphate, ammonium chloride, and ammonium sulphate respectively in varying dilutions was determined. The solubility of lithium carbonate in the sodium and potassium salts examined is greater than in water, whilst the solubility is still further increased by ammonium salts. A. McK.

**Solubility of Gypsum as affected by Size of Particles and by Different Crystallographic Surfaces.** GEORGE A. HULETT (*J. Amer. Chem. Soc.*, 1905, **27**, 49—56).—An account of the influence of the size of particles of calcium sulphate on its solubility has been given previously (*Abstr.*, 1901, ii, 493). Experiments have now been made for the purpose of ascertaining whether the different planes of a gypsum crystal vary in solubility. The results show that if there is any difference it is too small to be detected by the method employed, and that the values obtained for the solubility of gypsum by Hulett and Allen (*Abstr.*, 1902, ii, 656) in experiments in which the cleavage plane largely predominated are also the values for any plane of gypsum.

If powdered gypsum is shaken with water for three minutes, a supersaturated solution is produced, which requires seventeen days to reach a state of final equilibrium; if, however, plates of gypsum are used, the solution requires half a day or more to become saturated,

whereas most substances, under similar conditions, would form a saturated solution in about an hour. These facts explain the divergences in the solubility values of gypsum as given by different observers.

E. G.

**Bologna Phosphorus [Phosphorescent Sulphides].** LUDWIG VANINO and J. GANS (*J. pr. Chem.*, 1905, [ii], 71, 196—200. Compare Forster, *Ann. Phys. Chem.*, 1868, [ii], 133, 236; Klatt and Lenard, *Abstr.*, 1890, 201; Mourelo, *Abstr.*, 1899, ii, 484; 1900, ii, 141).—Barium sulphide, prepared by heating barium thiosulphate, is only slightly fluorescent, but if a mixture of 60 grams of barium thiosulphate, 6 c.c. of a 0.5 per cent. alcoholic uranium nitrate solution, and 12 c.c. of a similar bismuth nitrate solution is heated at 1300° for three-quarters of an hour, the product exhibits a strong yellowish-green phosphorescence, which is best seen in the largest fragments; a similar effect is produced by thorium nitrate. The presence of bismuth and uranium increases still more the phosphorescence of strontium sulphide obtained from the thiosulphate. Strontium sulphide containing lead and thorium exhibits a whitish-blue phosphorescence, but with lead only the effect is very slight. The golden phosphorescence of Klatt and Lenard's strontium sulphide is intensified by the addition of calcium fluoride.

The compositions of several of the best mixtures for the production of phosphorescent sulphides are given. In the absence of sunlight, the phosphorescence is most rapidly excited by Heraeus' mercury lamp, more slowly by a powerful Auer lamp.

G. Y.

**Solubility of Barium Sulphate.** FRIEDRICH W. KÜSTER and GEORG DAHMER (*Zeit. anorg. Chem.*, 1905, 43, 348—349).—When barium sulphate is boiled with a concentrated aqueous solution of chromic chloride for 5 days, or with a solution of chromic chloride acidified with hydrochloric acid for 10 days, it is found that in the former case the solution has dissolved from 40—120 times as much barium sulphate as does water, and in the latter case 450 times as much.

A. McK.

**Silicates. VI.** EDUARD JORDIS and E. H. KANTER (*Zeit. anorg. Chem.*, 1905, 43, 314—319. Compare *Abstr.*, 1903, ii, 475, 542, 595; this vol., ii, 88).—The study of the action of alkali earths on silica has been continued, pure powdered quartz being used. The analytical figures are quoted. In the barium and strontium series the preparations first made exhibit a high percentage of water in comparison with those made later. Uniform substances were not obtained.

A. McK.

**Silicates of the Alkaline Earths.** EDUARD JORDIS (*Zeit. anorg. Chem.*, 1905, 43, 410—415).—Historical. In the course of his researches, the author had overlooked the work of Le Chatelier (*Ann. des mines*, 1887, [8], 11, 345—464).

A. McK.



**Fluorides of the Heavy Metals.** EGON BÖHM (*Zeit. anorg. Chem.*, 1905, 43, 326—340).—*Mercurous fluoride*,  $\text{Hg}_2\text{F}_2 \cdot 4\text{H}_2\text{O} \cdot 4\text{HF}$ , prepared by the action of concentrated hydrofluoric acid on mercurous oxide, forms monoclinic crystals [ $a:b:c = 0.5673:1:1.060$ ;  $\beta = 105^\circ 10'$ ]. When carefully heated, it yields water, hydrogen fluoride, and mercuric oxide. *Copper fluoride*,  $\text{CuF}_2 \cdot 5\text{H}_2\text{O} \cdot 5\text{HF}$ , prepared from hydrofluoric acid and cupric oxide, forms blue, monoclinic crystals [ $a:b:c = 0.7513:1:0.557$ ;  $\beta = 105^\circ 10'$ ].

*Nickelous fluoride*,  $\text{NiF}_2 \cdot 6\text{H}_2\text{O} \cdot 5\text{HF}$ , and *cobaltous fluoride*,  
 $\text{CoF}_2 \cdot 6\text{H}_2\text{O} \cdot 5\text{HF}$ ,

are isomorphous. The compound  $\text{NH}_3 \cdot \text{HgF}$ , prepared by the action of an excess of ammonia on mercurous fluoride, is a yellow, amorphous powder. The compound  $\text{CuF}_2 \cdot 4\text{NH}_3 \cdot 5\text{H}_2\text{O}$ , prepared by the action of an excess of ammonia on cupric fluoride, forms rhombic crystals. The compound  $5\text{NiF}_2 \cdot 6\text{NH}_3 \cdot 8\text{H}_2\text{O}$ , prepared by the action of an excess of ammonia on nickel fluoride, forms bright green crystals. The following compounds are also described:  $\text{CoF}_2 \cdot 2\text{NH}_4\text{F} \cdot 2\text{H}_2\text{O}$ ;  $\text{Co}(\text{NH}_3)_6(\text{NO}_3)_2\text{F}$ ;  $\text{Co}(\text{NH}_3)_4\text{OHFNO}_2$ .

The compound  $[\text{Co}(\text{NH}_3)_4\text{F}_2]\text{Cl}$ , prepared by the action of hydrofluoric acid on tetramminecarbonatocobalt chloride, forms dark red, rhombic crystals. The compound  $\text{Co}(\text{NH}_3)_6\text{Cl}_2\text{F}$ , prepared by the action of hydrofluoric acid on luteocobalt chloride, forms yellow prisms, whilst the compound  $\text{Co}(\text{NH}_3)_6\text{F}_3$ , obtained as a by-product, forms yellow crystals.

A. McK.

**Formation of Complex Compounds with Mercury Thiocyanate.** HERMANN GROSSMANN (*Zeit. anorg. Chem.*, 1905, 43, 356—369. Compare Abstr., 1904, i, 983; ii, 406).—Mercurous thiocyanate, like the mercurous haloids, dissolves in potassium thiocyanate to form the complex  $\text{K}_2\text{Hg}(\text{CNS})_4$ , whilst mercury separates; the action is represented as follows:  $\text{Hg}_2(\text{CNS})_2 + 2\text{KCNS} \rightleftharpoons \text{K}_2\text{Hg}(\text{CNS})_4 + \text{Hg}$ . Mercuric thiocyanate dissolves in an aqueous solution of potassium thiocyanate more readily than does mercurous thiocyanate. Measurements of concentration cells according to Bodländer's method showed that the tetrathiocyanate,  $\text{K}_2\text{Hg}(\text{CNS})_4$ , exists in solution; in very dilute solutions, some trithiocyanate also exists.

The complex constant of the tetrathiocyanate is  $2.5 \times 10^{22}$ , which is greater at the ordinary temperature than that of the bromide; it decreases with rise of temperature and at  $52^\circ$  is identical with that of the bromide.

The solubility product of mercuric oxide may be calculated from Bersch's results.

The close relationships existing between the bromine and the thiocyanate ions are indicated by the author's results.

A. McK.

**Bibliography of the Rare Earths.** RICHARD J. MEYER (*Zeit. anorg. Chem.*, 1905, 43, 416—492).—This bibliography is arranged chronologically, references being given to 777 papers, extending over the years 1751—1905.

A. McK.

**Electrolytic Preparation of Ceric Ammonium Nitrate.**

GIUSEPPE PLANCHER and G. BARBIERI (*Atti R. Accad. Lincei*, 1904, [v], 14, i, 119—120).—The preparation of ceric ammonium nitrate either from ceric salts or by the action of oxidising agents on cerous ammonium nitrate is not easy to carry out and does not give good yields. Its electrolytic preparation, which has been unsuccessfully attempted by various authors, may, however, be readily effected as follows. As anode is used a large sheet of platinum which is wrapped round a thin porous pot. The anodic space is filled with a concentrated solution of cerous ammonium nitrate (50 grams of cerous nitrate and 25 grams of ammonium nitrate in 200 c.c. of solution), whilst the porous pot contains nitric acid into which dips the platinum wire cathode. Using a current of 0.1—0.2 ampere per sq. dm. of anode surface, the oxidation is almost quantitative, part of the ceric ammonium nitrate being deposited from the liquid and the remainder being separated by evaporation. T. H. P.

**Purification of Gadolinium, Atomic Weight of Gadolinium.**

GEORGES URBAIN (*Compt. rend.*, 1905, 140, 583—585).—From 1 kilogram of crude gadolinium earth containing only traces of europium and the element Z8 (compare Abstr., 1904, ii, 340, and this vol., ii, 35), the gadolinium was isolated by repeated fractional crystallisation of the double nitrate of nickel and gadolinium,  $2\text{Gd}(\text{NO}_3)_3 \cdot 3\text{Ni}(\text{NO}_3)_2 \cdot 24\text{H}_2\text{O}$ . The atomic weight of gadolinium was determined by converting the sulphate  $\text{Gd}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$  into the oxide  $\text{Gd}_2\text{O}_3$ , and the mean value thus obtained from 10 determinations on the first six fractions is 157.23, the limiting values being 157.04 and 157.35; the corresponding values obtained from the last five fractions is 157.25 with the limiting values 157.04 and 157.45 (compare Benedicks, Abstr., 1900, ii, 209).

M. A. W.

**Ultra-violet Spectrum of Gadolinium.** Sir WILLIAM CROOKES

(*Proc. Roy. Soc.*, 1905, 74, 420—422).—The gadolinium used in the experiments was purified by fractional crystallisation of the double nitrates of bismuth and magnesium with the rare earth nitrates. The phosphorescent spectrum of different specimens of gadolinium, purified in this manner, contains bands which the author has previously ascribed to a new element, victorium (Abstr., 1899, ii, 751). The new observations confirm the supposition that victorium is present in the gadolinium as an impurity. H. M. D.

**Monazite Earths.** WILHELM FEIT and CARL PRZIBYLLA (*Zeit.*

*anorg. Chem.*, 1905, 43, 202—214. Compare Muthmann and Weiss, Abstr., 1904, ii, 406).—The oxides of the cerium group of metals were separated from the crude product by the Demargay-Drossbach method. The preliminary separation of cerium was not, however, effected, except when the crude material was particularly rich in it, and in such cases permanganate was used for its partial removal. The separation yielded five fractions: (1) a large quantity of lanthanum, much cerium, a trace of praseodymium; (2) much lanthanum, much cerium, little praseodymium, a trace of neody-

mium; (3) little lanthanum, much cerium, much praseodymium, little neodymium; (4) a trace of cerium, little praseodymium, much neodymium, little samarium, traces of other earths; (5) a small amount of neodymium, much samarium, much gadolinium, and other earths. From the first fraction, praseodymium was removed by continued crystallisation, whilst the cerium was removed by permanganate; the residual lanthanum was then completely separated as oxalate. From the third fraction, praseodymium was separated from lanthanum by aid of the sparing solubility of its nitrate, as contrasted with lanthanum nitrate.

Praseodymium oxalate forms a black superoxide.

Samarium was separated from the fourth fraction by repeatedly crystallising the latter.

The praseodymium was more difficult to remove; its separation was finally effected by crystallising the solution, to which a fresh amount of cerium magnesium nitrate had been added. The neodymium oxide obtained was blue with a violet lustre.

The fifth fraction was repeatedly crystallised until the neodymium was completely removed. The separation of samarium from neodymium by the magnesium double nitrate method in the presence of considerable amounts of more easily soluble earths is easily performed. By continued fractionation, the yellow earths were completely removed, since terbium does not form a magnesium double nitrate. Samarium magnesium nitrate crystallises with difficulty. The observation of Demarçay that the separation of the double nitrates takes place in the following sequence, neodymium, samarium (europium), gadolinium, is confirmed by the authors. From the mixture containing samarium (europium) and gadolinium, the former was separated as the double nitrate.

The separation of a mixture of oxides which was completely free from lanthanum, cerium, and praseodymium, but contained much neodymium, samarium, and gadolinium, and the total amount of terbium, holmium, erbium, ytterbium, and yttrium present in the original crude material is described. Lanthanum, cerium, praseodymium, neodymium, and samarium were separated in the pure form.

Atomic weight determinations of neodymium gave the value 144.5 and of samarium 151.2, where  $O=16$  and lanthanum = 139.0 (3 determinations in each case). The authors do not claim, however, that these figures are accurate, although the value for neodymium is almost identical with Auer von Welsbach's value, and the value for samarium agrees closely with that of Muthmann and Weiss. A. McK.

**Terbium.** WILHELM FEIT (*Zeit. anorg. Chem.*, 1905, 43, 267—281).—A résumé of the literature on terbium is first given and the impurities mentioned to which the divergent values for the atomic weight of this element may be ascribed.

Thirty kilograms of monazite earths were freed from thorium (preceding abstract), the residue fractionated as magnesium double nitrate, the uncrystallisable fractions fractionated as nitrate in order to separate yttrium and erbium, and the more sparingly soluble nitrate again fractionated as the magnesium double nitrate. The mother



liquors from the latter crystallisation contained terbium together with samarium, holmium, erbium, yttrium, gadolinium, and ytterbium, the presence of the latter elements having been indicated spectroscopically. After 111 crystallisations, the greater portion of the terbium had accumulated in the more sparingly soluble fractions together with holmium, erbium, and yttrium. A further purification was effected owing to the varying solubility of the oxides of the different metals in their normal nitrates. Finally, crystallisation of the mixed oxalates was carried out. The preparation finally obtained gave the value for its atomic weight 158.6; it was a mixture of gadolinium oxide and terbium peroxide, and contained traces of holmium and yttrium. The amount of terbium present is more than 12 per cent.

A. McK.

**Special Constituent obtained in the Tempering of an Aluminium Bronze.** PIERRE BREUIL (*Compt. rend.*, 1905, 140, 587—590).—A copper aluminium alloy called *Fortior*, manufactured by Agésilas et Cie., contains traces of other elements, melts at 1010—1030°, has a singular point at 690—730°, and presents under the microscope a heterogeneous structure of white patches of copper or a compound of copper and aluminium embedded in a black matrix, probably the eutectic mixture. When tempered at 550°, much below the singular point, it becomes more homogeneous and granular; if the tempering be effected near the singular point, namely, between 650° and 750°, the structure of the metal changes, and a new constituent in the form of thin needles, similar to the martensite of tempered steels, appears embedded in the granular substance, and this change of structure is accompanied by a change in physical properties, namely, an increase in the elastic limit and breaking charge of the metal. As the temperature of tempering increases, the quantity of the martensitic constituent also increases, until at 950° it is the only constituent, and at the same time the elastic limit and the breaking charge are almost doubled. The effect of temper therefore on fortior is analogous to its effect on steels (compare Osmond, *Abstr.*, 1896, ii, 172); above the singular point, the fortior forms a solid solution, the crystalline form of which is not yet determined; the crystals break down at the singular point, giving rise to the constituents of the natural metal, and the effect of temper is to check this transformation.

M. A. W.

**Blue Aluminium Compounds deposited on the Aluminium Anode.** FRANZ FISCHER (*Zeit. anorg. Chem.*, 1905, 43, 341—347. Compare *Abstr.*, 1904, ii, 534).—When sulphuric acid of sp. gr. 1.175 is electrolysed with aluminium electrodes, layers of a bluish-green tint are deposited on the anode, especially when the electrolyte is kept cool; the portions of the deposit next to the electrode are, however, intensely blue. Microscopic examination indicated that this blue deposit is not a uniform substance. It is not acted on by distilled water. Dilute hydrochloric acid of such a strength as to act vigorously on aluminium at the ordinary temperature has scarcely any action on it. When warmed with hydrochloric acid, hydrogen is evolved, traces of silicic acid remaining: the filtrate gives a precipi-

tate with barium chloride and also contains aluminium. The product is free from sulphide and contains a basic aluminium sulphate, a little silicic acid, and traces of iron. When heated, it becomes white.

A. McK.

**A New Process for making Electrolytic Iron.** SERGIUS MAXIMOWITSCH (*Zeit. Elektrochem.*, 1905, 11, 52—53).—None of the processes described up to the present gives technically satisfactory results, the resulting iron being so brittle that it cannot be bent at all. A bath is made up to contain 20 per cent.  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and 5 per cent. of  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ ; to 6 litres of this solution, 25 grams of sodium hydrogen carbonate are added; the skin of ferric hydroxide which forms on the surface protects the bath from oxidation; the precipitate is allowed to settle to the bottom and to remain undisturbed; a wrought iron anode and a copper cathode (thinly silvered and iodised) are used. The bath is kept continuously at work and 20 to 25 grams of sodium hydrogen carbonate added about twice a week. The iron formed improves in quality as time goes on, finally reaching a strength of 5180 kilos. per sq. cm., and being so soft that it can be bent at a sharp angle without breaking. The best current density is 0.3 ampere [per sq. decimetre?], and the current efficiency is 97—99 per cent. The author attributes the good results to the small concentration of the hydrogen ions in the bath, which prevents the deposited iron from containing occluded hydrogen.

T. E.

**Action of Dilute Acids on Ferrous Sulphide.** ALFRED LIPSCHITZ and RUDOLF VON HASSLINGER (*Monatsh.*, 1905, 26, 217—225).—Pure ferrous sulphide reacts only extremely slowly with cold, dilute acids. "Active" ferrous sulphide, which evolves hydrogen sulphide with cold dilute acids, contains metallic iron; the hydrogen formed by the action of the acid on the free iron reduces the ferrous sulphide to hydrogen sulphide and iron, so that a small amount of free iron acts as an accelerator of the reaction.

When measured against a normal calomel electrode in a solution of ferrous sulphate and hydrogen sulphide in sulphuric acid, active ferrous sulphide has an *E.M.F.*  $-0.03$ , which is identical with that of iron; in a solution of ferrous sulphate in sulphuric acid, inactive ferrous sulphide has an *E.M.F.*  $+0.90$ , which is similar to the *E.M.F.* of pyrites,  $+0.89$ , of marcasite,  $+0.89$ , and of magnetic pyrites,  $+0.71$ , whilst in the same solution iron has an *E.M.F.*  $-0.03$ .

G. Y.

**Roussin's Salts [Nitrosulphides of Iron].** ITALO BELLUCCI and D. VENDITORI (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 28—36).—An historical paper.

T. H. P.

**Nitrosulphides of Iron.** ITALO BELLUCCI and D. VENDITORI (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 98—104).—The authors show that all the methods employed by various investigators for the preparation of salts similar to that first described by Roussin (*Ann. Chim. Phys.*, 1858, [iii], 52, 285), to which he ascribed the formula  $\text{Fe}_3(\text{NO})_4\text{S}_3\text{H}_2$ , yield compounds of the constitution  $\text{Fe}_4(\text{NO})_7\text{S}_3\text{X}$ . These salts con-

tain at least one molecule of water, which the authors consider may possibly be water of constitution and not of crystallisation. T. H. P.

**Physical Properties of Pure Cobalt and Pure Nickel.** H. COPAUX (*Compt. rend.*, 1905, 140, 657—659).—The cobalt was purified and freed from nickel by converting the chloride into pentamminocobaltic chloride, recrystallising, and converting this into cobalt oxalate, which was reduced to metal by heating in an atmosphere of hydrogen. It was then melted in a crucible in a current of hydrogen, the current being interrupted as soon as fusion was complete. By this method of operating, oxidation of the metal and absorption of hydrogen were reduced to a minimum.

The nickel was freed from cobalt by precipitating the latter from hydrochloric acid solution with excess of potassium nitrite, the solution being saturated with a current of nitrogen trioxide. The nickel was separated from the mother liquor in the form of the ammonia compound,  $\text{NiCl}_2 \cdot 6\text{NH}_3$ , which was converted into the oxalate, and the latter reduced in a current of hydrogen. In fusing the metal, similar precautions were taken to those described in the case of cobalt. It was found difficult to prevent change during the operation, for the metal oxidises very readily and absorbs considerable quantities of hydrogen. On this account, the nickel samples used in the determination of the electrical resistance and the breaking weight were prepared by subjecting the reduced nickel to hydraulic pressure, forging, turning, and annealing in a current of hydrogen.

The two metals prepared as described differ appreciably in appearance; the cobalt is brilliant and silver-white in colour, the nickel is comparatively dull.

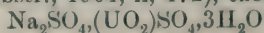
The following numbers are the measures of the physical properties examined:

	Cobalt.	Nickel.
Sp. gr. at 15° (water 4° = 1) .....	8.8	8.8
Hardness .....	5.5	3.5
Melting point .....	1530°	1470°
Specific heat (20—100°) .....	0.104	0.108
Electric resistivity (micro-ohms cm.) ...	5.5	6.4
Temperature-coefficient of resistivity ...	0.0055	0.0061
Breaking weight (kilograms per sq. mm.)	50	42

H. M. D.

**Cobalt Chloride Tetrahydrate.** WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1904, 1170—1171).—When anhydrous cobalt chloride is exposed to moist air, a tetrahydrate is formed; on further exposure, this is converted into the normal hexahydrate. T. A. H.

**Synthesis of Sodium Uranyl Sulphate by Spring's Process.** WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1904, 1171—1172).—When uranic hydrate,  $\text{UO}_3 \cdot \text{H}_2\text{O}$  (1 mol.), is mixed with sodium hydrogen sulphate (2 mols.) and the mixture compressed by Spring's method (*Abstr.*, 1904, ii, 472), the salt



is formed.

T. A. H.



**Cryoscopy of the Sulphates.** ALBERT COLSON (*Compt. rend.*, 1905, 140, 372—374. Compare Abstr., 1904, ii, 377, 532; this vol., ii, 34, 94).—A cryoscopic examination of aqueous solutions of Recoura's violet chromium sulphate (compare Abstr., 1892, 411; 1894, ii, 382) shows that it is truly isomeric with the green sulphate described by the author (this vol., ii, 94), the molecular complexity of the dissolved molecules being represented by  $\text{Cr}_2(\text{SO}_4)_3$ , and, further, the change to a green pentasulphate which occurs on boiling the violet solution is not accompanied by any change in the number of molecules, the freezing point of the solution after boiling remaining the same as before.

M. A. W.

**Crystalline Chromic Phosphate.** HUGO SCHIFF (*Zeit. anorg. Chem.*, 1905, 43, 304—307).—When sodium phosphate is added to an excess of a moderately concentrated aqueous solution of chrome alum, a reddish-grey gelatinous precipitate is first formed, which after 48 hours is transformed into dark violet, glistening crystals of chromium phosphate,  $\text{CrPO}_4 \cdot 6\text{H}_2\text{O}$ , which lose part of their water of crystallisation below  $100^\circ$ . The action is represented by the equation  $2\text{KCrS}_2\text{O}_8 + 2\text{Na}_2\text{HPO}_4 = 2\text{CrPO}_4 + \text{K}_2\text{SO}_4 + \text{H}_2\text{SO}_4$ .

At  $100^\circ$ , three molecules of water of crystallisation are lost.

If an excess of sodium phosphate is added, the violet, non-crystalline compound previously described by Rammelsberg, and also containing  $6\text{H}_2\text{O}$ , is formed. The green compound,  $\text{CrPO}_4 \cdot 2\text{H}_2\text{O}$ , is prepared by the action of acetic anhydride on the crystalline phosphate. The latter has the sp. gr. 2.121. Crystallographic measurements are appended.

A. McK.

**Tungsten Hexafluoride.** OTTO RUFF and FRITZ EISNER (*Ber.*, 1905, 38, 742—747).—The action of anhydrous hydrogen fluoride on tungsten hexachloride, in a copper-lined bomb, at the ordinary temperature leads to the formation of *tungsten hexafluoride*,  $\text{WF}_6$ ; the product is passed over titanium tetrachloride to absorb the excess of hydrogen fluoride and then into a paraffin-lined glass vessel, cooled to  $-70^\circ$ , at which temperature the product is solid. It vaporises without melting at  $-20^\circ$  under half an atmosphere, or at slightly over  $0^\circ$ , under 1 atmosphere pressure, to a gas which fumes in moist air, is easily soluble in aqueous alkalis, attacks most metals, especially when containing traces of hydrofluoric acid, and forms tungstic acid when acted on by water. It forms double salts with alkali fluorides and attacks glass, and, even after a short time, paraffined glass, with formation of silicon tetrafluoride and tungsten oxyfluoride.

Molybdenum pentachloride reacts with anhydrous hydrogen fluoride, forming a gaseous fluoride resembling tungsten hexafluoride.

G. Y.

**Oxyfluoride of Uranium.** FEDÉRICO GIOLITTI and G. AGAMENNONE (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 114—119).—The authors find that the action of hydrofluoric acid on the saline oxide of uranium,  $\text{U}_3\text{O}_8$ , to the products of which various compositions have been ascribed by different authors (compare Smithells, *Trans.*, 1883, 43,

125), proceeds according to the equation  $\text{U}_3\text{O}_8 + 6\text{HF} = \text{UOF}_2 + 2\text{UO}_2\text{F}_2 + 3\text{H}_2\text{O}$ . The uranous oxyfluoride,  $\text{UOF}_2$ , separates as a fine, green powder, whilst the oxyfluoride of sexavalent uranium,  $\text{UO}_2\text{F}_2$ , is obtained as a yellow mass on evaporating the solution. A heavy green powder is also deposited, and this contains a larger proportion of fluorine than uranous oxyfluoride, and is possibly uranium tetrafluoride.

T. H. P.

**Action of Silicon on Hydrated Metatitanic Acid.** GUSTAV TAMMANN (*Zeit. anorg. Chem.*, 1905, 43, 370—372).—When hydrated metatitanic acid is heated with powdered, crystallised silicon, the mixture begins to glow vigorously before the temperature of the mixture has risen to a red heat. Water and hydrogen are formed. Anhydrous titanic acid does not behave in this manner when heated with silicon. The action probably proceeds according to the equation  $2\text{TiO}(\text{OH})_2 + \text{Si} = \text{SiO}_2 + \text{Ti}_2\text{O}_3 + \text{H}_2\text{O} + \text{H}_2$ . Amorphous silicon does not behave like the crystalline variety in this action. Silicon has no action on hydrated silicic acid, zirconic acid, or aluminium hydroxide.

Hydrogen is evolved when titanium is heated with hydrated metatitanic acid. When a mixture of zirconium and hydrated titanic acid is heated in the absence of air, little gas is evolved, whilst the titanic acid is strongly reduced.

The behaviour of tungsten towards hydrated metatitanic acid is similar to that of silicon.

Metatitanic acid in the dry state acts as a carrier of oxygen in these experiments, the oxygen of the hydroxyl group being conveyed to silicon, tungsten, and titanium respectively and the hydrogen liberated. The latter burns in the air, whilst the mixture glows and the titanium oxide is oxidised.

A. McK.

**Zirconium Salts.** ARTHUR ROSENHEIM and PAUL FRANK (*Ber.*, 1905, 38, 812—816).—Zirconium hydroxide was heated with a saturated solution of hydrogen chloride in alcohol, the solution filtered from the excess of zirconium hydroxide, and hydrogen chloride passed into the filtrate. On addition of pyridinium chloride to the latter solution, the crystalline compound,  $(\text{C}_5\text{NH}_5)_2, \text{H}_2\text{ZrCl}_6$ , separated. With quinoline, the analogous compound,  $(\text{C}_9\text{NH}_7)_2, \text{H}_2\text{ZrCl}_6$ , was formed. The compound  $(\text{C}_5\text{NH}_5)_2, \text{H}_2\text{ZrBr}_6$  is very unstable.

The compound  $\text{Zr}_2\text{O}_3(\text{KSO}_4)_2, 8\text{H}_2\text{O}$ , prepared by the addition of normal potassium sulphate to a cold aqueous solution of zirconium sulphate, crystallises in small plates. The following compounds were prepared:  $\text{Zr}_2\text{O}_3(\text{RbSO}_4)_2, 15\text{H}_2\text{O}$  and  $\text{Zr}_2\text{O}_3(\text{CsSO}_4)_2, 11\text{H}_2\text{O}$ .

When an excess of freshly precipitated zirconium hydroxide is added to a hot concentrated solution of hydrogen potassium sulphate, the compound  $\text{Zr}(\text{KSO}_4)_4, 3\text{H}_2\text{O}$  is precipitated as needles.

A. McK.

**Metazirconic Acid.** RUDOLF RUER (*Zeit. anorg. Chem.*, 1905, 43, 282—303).—The changes undergone by an aqueous solution of zirconium oxychloride at the ordinary temperature and when boiled have been examined by the author. A new zirconium hydroxide is described, the relationship of which to the zirconium hydroxide already

known is the same as that of metastannic acid to ordinary stannic acid.

Zirconium oxychloride is suitable for the purification of zirconium earths. At the ordinary temperature, it undergoes hydrolysis in aqueous solution; this was proved by determinations of its electrical conductivity, which at first increases rapidly and attains to a constant value after 3 days. The behaviour of the aqueous solutions towards oxalic acid and ammonium oxalate in the presence of acids and sulphates also indicated that a hydrolytic change had occurred. When an aqueous solution of zirconium oxychloride is boiled for a short time, the hydrolysis undergone and the alteration of the analytical behaviour of the solution are marked. Such solutions form, for instance, with sodium sulphate and ammonium sulphate respectively, precipitates which are redissolved by an excess of precipitant; the precipitate, formed on the addition of dilute sulphuric acid, is slowly dissolved by an excess of the latter.

When a solution of zirconium oxychloride is boiled, the hydroxide formed by hydrolysis is transformed into another hydroxide, metazirconic acid. This transformation proceeds slowly, is perceptible after 2 hours, and is detected by a comparison of the colloidal hydroxide obtained from the cold and boiled solutions of the oxychloride respectively.

Metazirconic acid is best prepared by repeatedly boiling and subsequently diluting a 1 per cent. solution of zirconium oxychloride. Its reactions are analogous to those of metastannic acid. By concentrated hydrochloric acid, it is transformed very slowly into ordinary zirconium chloride. By the action of sulphuric acid on it, zirconium sulphate is produced.

Metazirconic acid, dried at  $100^{\circ}$ , has the formula  $3\text{ZrO}_2 \cdot 2\text{H}_2\text{O}$ , whereas ordinary zirconium hydroxide, dried at  $100^{\circ}$ , has the formula  $\text{ZrO}_2 \cdot \text{H}_2\text{O}$ .

Colloidal solutions are formed by metazirconic acid and by its compounds with acids.

The two forms of zirconium hydroxide probably correspond with two different oxides. The oxide corresponding with ordinary zirconium hydroxide could not be obtained anhydrous; the oxide corresponding with metazirconic acid is probably the ordinary zirconium oxide.

The isomerism of the hydroxides of zirconium and of tin is also observed with the hydroxides of titanium and thorium. A. McK.

**Uniform Nature of Thorium.** RICHARD J. MEYER and A. GUMPERZ (*Ber.*, 1905, **38**, 817—825).—Baskerville (*Abstr.*, 1902, ii, 85; 1904, ii, 663) claims that thorium is a mixture of at least three elements. The experiments quoted by the authors are at variance with this view.

Baskerville does not quote sufficient detail as to the source of the thorium oxide used in his work. He determines the equivalent of thorium by converting a weighed quantity of the oxide into the anhydrous sulphate; his description is again inadequate and the method is faulty.



The authors dehydrated thorium sulphate octohydrate at  $400^{\circ}$  and determined the ratio  $\text{Th}(\text{SO}_4)_2 : \text{ThO}_2$  by converting a weighed quantity of the anhydrous salt into the dioxide. The method was applied to the determination of the atomic weight of thorium in several of the chromate fractions obtained from thorium nitrate by Muthmann and Baur's method; the results do not indicate that thorium was not uniform.

When thorium chloride was sublimed in a current of chlorine in three fractions, the determinations of the atomic weight of the metal in these reactions yielded practically identical figures, corresponding with the recognised atomic weight of thorium. This result is at variance with Baskerville's.

A. McK.

**Spectrographical Investigation of Some Thorium Preparations.** G. EBERHARD (*Ber.*, 1905, 38, 826—828. Compare preceding abstract).—Examination of the spectrum of thorium preparations from various sources did not indicate that in any of these preparations thorium had been resolved into any new elements. Any observed variations from the spectrum of pure thorium could be accounted for by the ordinary impurities.

A. McK.

**Halogen Double Salts of Quadrivalent Antimony.** RUDOLF F. WEINLAND and HANS SCHMID (*Ber.*, 1905, 38, 1080—1087).—In the solution in hydrochloric acid an equilibrium exists between antimony tetrachloride and antimony tri- and penta-chlorides, according with the scheme  $\text{SbCl}_3 + \text{SbCl}_5 \rightleftharpoons 2\text{SbCl}_4$ . The amount of tetrachloride increases as the temperature is raised or the concentration of the hydrochloric acid increased. A salt,  $\text{Rb}_2\text{SbCl}_6$ , is formed on adding rubidium chloride to such an equilibrium mixture, along with hot concentrated hydrochloric acid; it forms a black, microcrystalline powder composed of glittering octahedra and is at once decomposed by water. A salt,  $\text{Rb}_2\text{SbCl}_6 \cdot 2\text{Rb}_3\text{SbCl}_6$ , crystallising in brown, glistening, transparent, hexagonal plates, is formed if the equilibrium mixture is merely mixed with rubidium chloride at the ordinary temperature. With ammonium chloride, a series of salts has been obtained. From solutions containing quadrivalent antimony, ammonium chloride, and platinic chloride in hydrochloric acid, transparent brownish-violet to opaque black crystals,  $(\text{NH}_4)_2(\text{Sb,Pt})\text{Cl}_6$ , are obtained, according to the amount of platinum salt present. With tin tetrachloride, light to dark violet salts,  $(\text{NH}_4)_2(\text{Sb,Sn})\text{Cl}_6$ , are formed. A salt,  $(\text{NH}_4)_2\text{SbCl}_6 \cdot (\text{NH}_4)_3\text{SbCl}_6$ , is obtained in brown, glistening, hexagonal plates. The potassium salt,  $\text{K}_2(\text{Sb,Pt})\text{Cl}_6$ , forms a dark violet powder. The pyridine salt,  $4(\text{SbCl}_6\text{H}_{12} \cdot 2\text{C}_5\text{H}_5\text{N}) \cdot (\text{SbCl}_6\text{H}_3 \cdot 3\text{C}_5\text{H}_5\text{N})$ , is obtained as a blackish-brown, crystalline powder, whilst  $2(\text{SbCl}_6\text{H}_{12} \cdot 2\text{C}_5\text{H}_5\text{N}) \cdot (\text{SbCl}_6\text{H}_3 \cdot \text{C}_5\text{H}_5\text{N})$  crystallises in characteristic glistening, rhombic plates.

E. F. A.

**Tantalum, its Preparation and Properties.** WERNER VON BOLTON (*Zeit. Elektrochem.*, 1905, 11, 45—51).—Vanadium pentoxide, in the form of compressed powder, conducts electricity well at the ordinary temperature. Small rods of vanadium trioxide were made by heating rods of a plastic mixture of the pentoxide and paraffin in

powdered charcoal at  $1700^{\circ}$  for some hours. These rods were then attached to platinum wires and heated electrically in a glass vessel, which was continually exhausted by a mercury pump, when pure oxygen was evolved and a rod of metallic vanadium left. The melting point of the metal, determined photometrically, was  $1680^{\circ}$ .

Rods of columbium tetroxide were made and treated in the same way. The metal obtained was more ductile than vanadium and melted at  $1950^{\circ}$ .

Tantalum is prepared from the tetroxide in the same way, the white-hot oxide is decomposed electrolytically into oxygen and metal, which recombine sufficiently slowly to allow the oxygen to be removed. Larger quantities of the metal are prepared by a modification of Berzelius' method, which yielded a product containing 98.5 to 99 per cent. of the metal. This powder is compressed and heated in an electric arc in a vacuum, the oxides of tantalum fuse, and are dissipated in the form of dust much more readily than the metal, and it is possible to free the latter from them completely and thus obtain ingots of the perfectly pure metal. For commercial reasons, details of the methods employed are not given. The following physical constants of pure tantalum have been determined: specific heat, 0.0365; atomic heat, 6.64; sp. gr., fused metal, 16.64; wire, 0.05 mm. diameter, 16.5. When the wire is heated to whiteness in a vacuum, it becomes denser and crystalline, its sp. gr. finally reaching that of the fused metal. Coefficient of linear expansion from  $0^{\circ}$  to  $50^{\circ} = 0.0000079$ . Specific resistance 0.165 ohm for a wire 1 metre long and 1 sq. mm. cross section. The resistance increases 0.3 per cent. per degree between  $0^{\circ}$  and  $100^{\circ}$ , and 0.26 per cent. per degree between  $0^{\circ}$  and  $350^{\circ}$ . In dilute nitric acid, tantalum stands between platinum and silver in its electrochemical properties. The modulus of elasticity of the wire (0.08 mm. dia.) was found to be 19,000 kilograms per sq. mm., its breaking stress, 93 kilograms per sq. mm.; this increases, however, as the diameter of the wire diminishes, reaching 150 to 160 kilograms per sq. mm. for wire 0.05 mm. thick. The extension of the wire before breaking is small, being only 1 to 2 per cent., notwithstanding which wires of 0.03 mm. diameter can be drawn. An ingot of the metal beaten out under the steam hammer to a sheet 1 mm. thick was drilled with a diamond drill making 5000 revolutions per minute for 72 hours continuously, after which a depression of about  $\frac{1}{4}$  mm. was found, the diamond drill being much worn; the metal therefore combines extraordinary hardness with great ductility. Immersed in dilute sulphuric acid, tantalum only allows currents to pass when it is the cathode, when it is the anode no current passes even with 220 volts, owing to the formation of a film of oxide. Compact tantalum may be etched with hydrofluoric acid; the appearance of the surface is a good guide to the purity of the metal. The melting point of the pure metal is about  $2250^{\circ}$ ; its electrical dissipation as dust when used in a vacuum is extremely small. Many experiments with incandescent electric lamps made with a tantalum wire filament showed that their useful life is about the same as with a carbon filament, whilst the electrical energy consumed is less than half.

In making tantalum by the action of sodium on potassium tantalum fluoride, much hydrogen is evolved, part of which is absorbed by the

metal ; it may be driven out by heating in a vacuum. Red-hot tantalum powder decomposes water, giving off hydrogen. When the powder is placed in a platinum dish containing dilute acid and is made the cathode, it takes up very large quantities of hydrogen, which is not driven off completely even by fusion, the fused metal being hard and brittle. Traces of hydrogen, however, do not affect its ductility. Compact tantalum, when heated in the air, becomes yellow at  $400^{\circ}$ , blue at a dull red heat, and is finally covered with a layer of the white pentoxide which protects the metal below it. Thin wire however, burns with a white light without flame. Metallic tantalum heated to whiteness does not combine with oxygen if its pressure is less than 20 mm. ; this explains the possibility of preparing the metal by heating the oxide in a vacuum.

When heated in nitrogen, it becomes dull grey and brittle, the powdered metal combines readily with sulphur, selenium and tellurium. Iron alloys containing from 5 to 10 per cent. of tantalum are very hard and ductile. Silver does not alloy with tantalum at all, and the same is true of mercury. Molybdenum and tungsten alloy readily with it ; the alloys containing less than 5 per cent. of these metals are ductile. More than 1 per cent. of carbon renders tantalum too brittle to be drawn into wire, but metal containing 0.5 per cent. of carbon can still be drawn into wire 0.1 mm. thick. Traces of carbon, boron, or silicon add to its hardness without diminishing its ductility. Boiling sulphuric, nitric, or hydrochloric acid or mixtures of these are without action on compact tantalum. Hydrofluoric acid acts on it very slowly unless the metal is in contact with platinum. Aqueous solutions of alkalis are also without action, but fused alkalis cause it to disintegrate.

T. E.

**Supposed Allotropy of Gold.** WILLEM J. VAN HETEREN (*Chem. Centr.*, 1905, i, 503 ; from *Chem. Weekblad*, 2, 47—53).—It has been stated by Julius Thomsen that different allotropic modifications of gold are obtained by the reducing action of sulphurous acid on various solutions of gold compounds. The supposed allotropic forms obtained by the reduction of (a) neutral auric chloride, (b) auric bromide, (c) aurous chloride, bromide, or iodide have been designated respectively as gold,  $\text{gold}_a$ , and  $\text{gold}_\beta$ . The author finds, that, when galvanic cells are constructed with gold and  $\text{gold}_a$  or gold and  $\text{gold}_\beta$  as reversible electrodes, the observed potential differences at  $25^{\circ}$  (0.4—0.6 millivolt) are not greater than when two samples of the first allotropic form are employed as electrodes.

From the values given by Thomsen for the heat changes accompanying the transformation of  $\text{gold}_a$  and  $\text{gold}_\beta$  into gold, a large temperature-coefficient of the *E.M.F.* of such cells would be expected. Measurements at  $0^{\circ}$ , however, gave the same result as at  $25^{\circ}$ .

H. M. D.

**Electrolytic Solution of Platinum in Sulphuric Acid.** ANDRÉ BROCHET and JOSEPH PETIT (*Compt. rend.*, 1905, 140, 655—657).—When a direct current of rapidly varying intensity is passed through a solution of sulphuric acid containing an anode of platinum, the latter

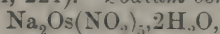


dissolves and platinum separates at the cathode. The addition of an oxidising agent diminishes the rate of solution of the platinum and also prevents its separation at the cathode. The electrolytic solution of the anode is not therefore due to a specific action of the alternating current, but is attributable to the rapidly alternating current density at the anode. The authors consider that Ruer's conclusions (Abstr., 1903, ii, 407) are untenable.

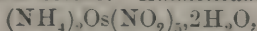
The phenomenon is quite different from that observed when an alternating current is passed through a cyanide solution between platinum electrodes. In this case, the electrolytic solution is due to pulverisation of the cathode in consequence of the primary formation of an alloy, which is attacked by water, the platinum being left in an altered physical condition in which it dissolves spontaneously in the cyanide solution (compare Abstr., 1904, ii, 414; 1905, ii, 27, 28).

H. M. D.

**Some Osminitrites and an Osmium Nitrite.** L. WINTREBENT (*Compt. rend.*, 1905, 140, 585—587).—Potassium osminitrite crystallises in canary-yellow, flattened parallelopipeds, very soluble in water (compare Abstr., 1903, ii, 221). *Sodium osminitrite*,

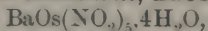


more soluble than the potassium salt, crystallises in flattened parallelopipeds of an orange-yellow colour. *Ammonium osminitrite*,

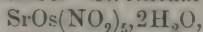


prepared by the action of ammonium sulphate on the barium salt, forms beautiful, orange-yellow crystals, stable in dry air and decomposed at  $160^\circ$  in an atmosphere of hydrogen, forming osmium peroxide.

*Silver osminitrite*,  $\text{Ag}_2\text{Os}(\text{NO}_2)_5 \cdot 2\text{H}_2\text{O}$ , forms golden-yellow crystals, stable in dry air. *Barium osminitrite*,  $\text{BaOs}(\text{NO}_2)_5 \cdot \text{H}_2\text{O}$  and



are obtained by the action of barium chloride on a hot solution of potassium osminitrite, the monohydrate being obtained in the form of yellow plates above  $15^\circ$ , and the tetrahydrate in the form of amber-yellow needles at a lower temperature. *Strontium osminitrite*,



forms orange crystals; *calcium osminitrite*,  $\text{CaOs}(\text{NO}_2)_5 \cdot 4\text{H}_2\text{O}$ , orange-yellow plates; *magnesium osminitrite*,  $\text{MgOs}(\text{NO}_2)_5 \cdot 4\text{H}_2\text{O}$ , sulphur-yellow crystals, and *zinc osminitrite*,  $\text{ZnOs}(\text{NO}_2)_5 \cdot \frac{1}{2}\text{H}_2\text{O}$ , orange-yellow crystals. When a solution of barium osminitrite is precipitated by an equivalent quantity of sulphuric acid, a solution of osminitrous acid,  $\text{H}_2\text{Os}(\text{NO}_2)_5$ , is obtained, from which, on complete evaporation, *osmium nitrite*,  $\text{Os}(\text{NO}_2)_3$ , is obtained in the form of a deep brown powder.

M. A. W.

## Mineralogical Chemistry

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**Iodobromite in Arizona.** WILLIAM P. BLAKE (*Amer. J. Sci.*, 1905, [iv], 19, 230).—A soft, yellow mineral occurring as thin seams and crusts in a quartz and calcite vein near Globe, Pinal Co., Arizona, was found by its blowpipe reactions to contain silver, iodine, bromine, and chlorine; its identity with iodobromite is, however, not proved (compare iodembolite, Abstr., 1902, ii, 403). L. J. S.

**Formation of Oceanic Salt Deposits. XL. Limits of Existence of Tachyhydrite.** JACOBUS H. VAN'T HOFF and L. LICHTENSTEIN (*Sitzungsber. K. Akad. Wiss. Berlin*, 1905, 232—235).—The experiments were made at 25° and consisted in determining the composition of solutions which were saturated with sodium chloride and also with one of the following systems: (1) calcium chloride, (2) magnesium chloride, (3) magnesium chloride and tachyhydrite, (4) potassium chloride, (5) potassium chloride and calcium chloride, (6) magnesium chloride and carnallite, (7) magnesium chloride, carnallite, and tachyhydrite, (8) carnallite and potassium chloride, (9) carnallite, potassium chloride, and calcium chloride, (10) tachyhydrite and calcium chloride, (11) tachyhydrite, calcium chloride, and carnallite. The results are represented in the usual graphical manner. J. C. P.

**Action of Barium and Strontium Chlorides on Kaolin at High Temperatures.** Z. WEYBERG (*Centr. Min.*, 1905, 138—142).—Kaolin, when fused for some time with an excess of barium chloride, gave a crystallised product having the composition  $7\text{SiO}_2, 4\text{Al}_2\text{O}_3, 4\text{BaO}$ ; the crystals are hexagonal and hemimorphic, and are optically uniaxial and negative, thus agreeing with nephelite in physical characters. The corresponding strontium compound was obtained by a similar method. In both cases, the crystallised product contained also isotropic irregular grains with the composition  $30\text{SiO}_2, 4\text{Al}_2\text{O}_3$ . L. J. S.

**Dumortierite.** WALDEMAR T. SCHALLER (*Amer. J. Sci.*, 1905, [iv], 19, 211—224).—A dyke in granite at Dehesa, San Diego Co., California, consists in the upper part of a fine-grained rock composed of quartz and sillimanite, whilst the lower part is a coarse rock consisting of quartz and dumortierite with small amounts of sillimanite and muscovite, &c. The dumortierite is lavender in colour, instead of the usual blue colour of this mineral, and forms irregular masses with ragged outlines or fan-shaped radiating masses several centimetres across. The pleochroism is marked, being colourless to deep reddish-purple. There is a prismatic cleavage parallel to (210). Measurement of imperfectly developed crystals from this and from two other American localities proves the mineral to be orthorhombic with the axial ratios  $[a:b:c = 0.8897:1:0.6871]$ . The chemical analysis of the mineral presents some difficulties; the mean of two analyses made on pure material gave the results under I. Regarding the titanium to

be present as  $\text{Ti}_2\text{O}_3$  replacing alumina, the formula is deduced as  $8\text{Al}_2\text{O}_3, \text{B}_2\text{O}_3, \text{H}_2\text{O}, 6\text{SiO}_2$ , which may be written as  $(\text{SiO}_4)_3\text{Al}(\text{AlO})_7(\text{BO})\text{H}$ . This formula is similar to that of the closely allied mineral andalusite,  $[(\text{SiO}_4)_3\text{Al}_3(\text{AlO})_3]$ , and it explains the alteration of dumortierite to muscovite,  $[(\text{SiO}_4)_3\text{Al}_3\text{KH}_2]$ . The recent analyses by Ford (Abstr., 1903, ii, 158) are shown to agree with the new formula, except for a slight difference in the water, which was not determined directly in Ford's analyses.

	$\text{SiO}_2$	$\text{Al}_2\text{O}_3$	$\text{TiO}_2$	$\text{Fe}_2\text{O}_3$	$\text{H}_2\text{O}$	$\text{B}_2\text{O}_3$	$\text{CaO}$	Total.	Sp. gr.
I.	28.68	63.31	1.45	0.23	1.52	5.37	—	100.56	3.306
II.	28.51	59.75	0.95	2.48	2.12	5.54	0.68	100.03	—

A description is also given of the dumortierite from Skamania Co., Washington, which occurs as blue spherulites and brushes in a rock composed of andalusite, quartz, and muscovite; analysis of not quite pure material gave the results under II.

L. J. S.

**The Billings Meteoric Iron.** HENRY A. WARD (*Amer. J. Sci.*, 1905, [iv], 19, 240—242).—This iron was found near Billings, Christian Co., Missouri, in 1903. The weight before cutting was 54lbs., and it was much rusted on the surface. The structure is coarsely octahedral. Analysis by H. W. Nichols gave:

Fe.	Ni.	Co.	Cu.	Si.	P.	S.	Total.
91.99	7.38	0.42	0.01	0.08	0.15	0.06	100.09

L. J. S.

## Physiological Chemistry.

**Cheyne-Stokes Respiration.** MARCUS SEYMOUR PEMBREY and RICHARD W. ALLEN (*Proc. Physiol. Soc.*, 1904—1905, xviii—xx; *J. Physiol.*, 32).—The gas analyses made lead to the conclusion that this form of breathing is due to a lessened excitability of the nervous system. The carbon dioxide accumulates, and the oxygen diminishes in the blood until at last the nerve-cells of the respiratory centre are stimulated, respiration begins and increases until the carbon dioxide is washed out and a large quantity of oxygen taken in; this is followed by lessening and then cessation of the respiratory efforts, the amount of carbon dioxide being insufficient to stimulate action until it again accumulates.

W. D. H.

**Clinical Measurement of Electrical Conductivity.** T. M. WILSON (*Amer. J. Physiol.*, 1905, 13, 139—153).—The electrical method of determining the relative volume of corpuscles and plasma gives results which agree well with hematocrite determinations. The



conductivity of serum is approximately the same as that of plasma. A small apparatus is described which can be used with only a small error for determining conductivity in a few drops of blood for clinical purposes. In thirteen healthy men, the conductivity of the blood varied from 35.3 to 52.6, and of serum from 84 to 111. In one healthy person over a period of five weeks the same numbers varied from 40.2 to 46.7 and 86.5 to 111 respectively. A few observations were also made in pathological cases.

W. D. H.

**Action of Chloroform on the Blood-vessels of Bowel and Kidney.** E. H. EMBLEY and CHARLES J. MARTIN (*J. Physiol.*, 1905, 32, 147—158).—The action of chloroform in the blood in such quantities as may occur with the inhalation of 1 to 3 per cent. of vapour in the air paralyses the neuro-muscular mechanism of the blood-vessels of the kidney and bowel, and this partly accounts for the fall of blood-pressure which occurs. Such results are not contradictory to those of Schäfer and Scharlieb (this vol., ii, 105), but supplementary; vessels in different parts may react in different ways to the same poison in different doses. The dilatation is mainly confined to the splanchnic area. The paper also contains a description of a new perfusion apparatus.

W. D. H.

**Effect of Salts of Potassium and Ammonium and of Bile Salts on Blood Pressure.** ARTHUR EDMUNDS (*Proc. Physiol. Soc.*, 1904—1905, xx; *J. Physiol.*, 32; *Brit. Med. J.*, 1905, i, 57—59).—A mere inspection of the crystals of choline platinichloride is insufficient to distinguish it from those of the potassium, ammonium and bile salts. A more detailed examination of its composition, solubilities, &c., is necessary. The present paper urges that combined with chemical testing, the investigation of the physiological action of the substance should be carried out. The fall of arterial blood pressure produced by choline is abolished if the animal has been previously poisoned with atropine. The other substances named above also produce a fall of arterial pressure if employed in solutions of sufficient strength, but in several points this differs from that produced by choline, notably in the circumstance that it is not abolished by atropine.

W. D. H.

**Effect on Blood-pressure of Proteolytic Products.** CHARLES G. L. WOLF (*J. Physiol.*, 1905, 32, 171—174).—Glycine, leucine, tyrosine, uracil, cytosine, indole, scatole, tryptophan, xanthine, hypoxanthine, guanine, thymine, glycine ethyl ester, pyrrolidine-2-carboxylic acid,  $\alpha$ -methylpyrrolidinecarboxylic acid, arginine, or glutamic acid produces no fall of blood pressure when injected intravenously. These simple products of proteolysis do not produce the "peptone" effect; the latter is the result of a combination of groups. Nolf (*Abstr.*, 1904, ii, 425) states that a product of pancreatic autolysis which no longer gives the biuret reaction lowers the blood pressure. It is probable, however, that this is due to choline, a substance found in autolysed pancreas and yeast as a result of lecithin decomposition (Kutscher and Lohmann, *Abstr.*, 1903, ii, 670, 737). Levene's glucothionic acid produces a rise of blood pressure.

W. D. H.

**Effect on Blood Pressure of Polypeptides.** WILLIAM D. HALLIBURTON (*J. Physiol.*, 1905, 32, 174).—W. H. Thompson showed that the blood pressure lowering effect of "peptone" is mainly due to primary proteoses; the further proteolysis is continued, the less is the effect manifested. Similar results were obtained with protamines and protones. Crystalline cleavage products have not the power (see Wolf, preceding extract). Negative results were also obtained with four of Fischer's polypeptides (leucyl-leucine, leucyl-glycine, glycyl-asparagine, and alanyl-leucyl-glycine). The combinations of molecular groups necessary to produce the effect must therefore be more complex than the polypeptides.

W. D. H.

**Blood Ferments.** ADOLF JOLLES and OPPENHEIM (*Chem. Centr.*, 1905, i, 546; from *Münch. med. Woch.*, 51, 2083—2085).—The catalases of the blood eliminate oxygen from oxyhæmoglobin; this is transferred to the tissues by oxydases. The catalase is destroyed by boiling and by acids. Various reagents differ in their effect on the ferments. The catalase is contained exclusively in the formed elements, its amount being roughly proportional to that of the hæmoglobin. No difference in this respect obtains in venous and arterial blood, or in that of men and women. The amount falls in tuberculosis, nephritis, and cancer. In a series of animals, the amount of catalase and the intensity of oxidation processes appear to go together.

W. D. H.

**Physico-chemical Researches on Hæmolysis.** VICTOR HENRI (*Compt. rend.*, 1905, 140, 101—104).—The experiments presented relate to the hæmolysis produced in fowls by the serum of dog's blood, and have led to the following conclusions. The rapidity of hæmolysis is independent of the quantity of red corpuscles placed in contact with given amounts of serum, but a given amount of serum is only capable of hæmolysing a limited number of corpuscles. The velocity of action increases with increasing amounts of serum, but more rapidly than the increase of serum. It is only slow in the first 5 or 10 minutes, then increases rapidly, and diminishes again towards the end. If the total quantity of corpuscles hæmolysed at the end is represented by  $a$ , and the quantity hæmolysed at the end of  $t$  minutes is  $x$ , the fraction  $\frac{1}{t} \log \frac{a}{a-x}$  is a constant.

W. D. H.

**Hydrolysis of Hepatic Glycogen produced by Injection of Amylase into the Portal Vein.** PARISSET (*Compt. rend.*, 1905, 140, 534—537).—The quantity of sugar in the blood of the hepatic vein is increased by injecting a solution of amylase into the portal vein. This is considered to support the view that the normal change of glycogen is produced by an amylolytic ferment in the portal blood.

W. D. H.

**Assimilation of Calcium and Phosphoric Acid from Various Calcium Phosphates by Growing Animals.** ALBIN KOHLER, FR. HONCAMP, M. JUST, JUSTUS VOLHARD, M. POPP, and OTTO ZAHN (*Landw. Versuchs-Stat.*, 1905, 61, 451—479).—With the exception of

pure precipitated tricalcium phosphate, which is much more readily assimilated than degelatinised bone-meal, calcium phosphates which are only slightly soluble in Petermann's citrate solution are of slight feeding value. The highest results were obtained (in an experiment with only one lamb) when calcium diphosphate was given together with calcium lactate.

N. H. J. M.

**The Gastric Mucous Membrane and Gastric Juice of the Pig.** F. BENGEL and GUNNAR HAANE (*Pflüger's Archiv*, 1905, 106, 267—285, 286—312).—The cardiac region of the pig's stomach contains only an amylolytic ferment; the fundus region contains a peptic, an amylolytic, a rennetic, and a weak lipolytic ferment. In the pyloric region, the three first named are also present, but in smaller amount and not so active. The pepsin is most abundant in the fundus glands during the first hour of digestion; at the seventh hour, it falls, and rises again at the ninth or tenth. In the pyloric glands, it is at its maximum one or two hours later, and then falls until the end of digestion (12th hour). The fundus glands secrete more acid and more mucin than those in other regions. The other ferments vary in amount and activity at various times, so also does the acid.

W. D. H.

**Chemico-physiology of Betaine. II.** ALOIS VELICH and VLADIMÍR STANĚK (*Zeit. Zuckerind. Böhm.*, 1905, 29, 205—219).—The breaking-down of betaine in the digestive organs of a sheep increases as the time during which it is administered is increased, and as the nitrogen-content of the other food is diminished. The products of its decomposition are substances which yield ammonia and dimethylamine on hydrolysis, and are presumably urea and a methylated urea. The secretion of amino-acids in the urine undergoes no change during the period in which betaine is administered, but there is a continuous increase in the amount of nitrogen present as compounds which cannot be identified. In the first few days, betaine acts as a mild diuretic and produces an increase of nitrogen in the faeces, but does not itself occur in the latter. The authors conclude that betaine plays a definite part in the animal organism. Small proportions of betaine may be detected in sheep's urine, but no trace of betaine could be found in the urine of a cow fed daily with molasses.

T. H. P.

**Nuclein Bases produced during the Autofermentation of Pancreas.** MARTIN SCHENCK (*Zeit. physiol. Chem.*, 1905, 43, 406—409. Compare Schittenhelm, Abstr., 1904, ii, 752, and this vol., i, 108; Jones and Partridge, Abstr., 1904, ii, 838; Levene, Abstr., 1904, ii, 828).—Finely-divided fresh pancreatic glands were allowed to undergo autofermentation in the presence of chloroform water, and after removal of tyrosine, histidine, and arginine the purine bases were isolated by Krüger and Salomon's method. The only bases obtained were guanine and hypoxanthine; xanthine and adenine could not be isolated, and if formed at all were only present in minute quantities. These results can be explained on the supposition that adenase and guanase are two distinct ferments, and that in the extracts examined guanase was not present.

J. J. S.



**The Kinetics of Tryptic Action.** WILLIAM M. BAYLISS (*Arch. Sci. Biol. St. Petersburg*, 1904, 11, *Suppl.* 281—297).—The electrical conductivity method was the one mainly employed. The typical curve of the velocity of trypsin action differs from a logarithmic curve in that it gradually falls away from such a curve, owing to the retarding action of the products of cleavage, especially amino-acids. The chief cause of increase of conductivity during digestion is probably the splitting off of inorganic constituents, and in the case of caseinogen the formation of inorganic phosphates. Amino-acids also have a slight action in this direction. The existence of a weak proteolytic enzyme in unactivated juice and of anti-trypsin in serum and egg-white is confirmed. There is some evidence of reversible action on the part of trypsin.

W. D. H.

**Autolysis. II. The Influence of the Thyroid.** SAMUEL B. SCHRYVER (*J. Physiol.*, 1905, 32, 159—170).—The livers of thyroid-fed animals show a greater autolysis after 24 hours than those of non-thyroid-fed control animals. But if the preliminary thyroid feeding lasts more than eight days, the reverse occurs. Thyroid feeding leads to excessive oxidation and burning up of fat, and so contrasts with phosphorus poisoning, where oxidation is lessened and fat accumulates. A full explanation of the action of the thyroid, whether on the tissues or on the autolytic enzymes or on substances which inhibit the enzyme action, is still wanting.

W. D. H.

**Inactive Arginine.** E. PROVAN CATHCART (*Proc. Physiol. Soc.*, 1904—1905, xv; *J. Physiol.*, 32).—In "urotryptic" digestion of fibrin, the arginine fraction was obtained in crystalline form and was found to be inactive. There is no sharp melting point, but decomposition begins at 210°. The melting point of the active form is 175°. Kutscher obtained the inactive form from a digestion of fibrin with pancreas, or by the treatment of the active form with sulphuric acid.

W. D. H.

**Carbohydrate Combustion. III.** OTTO COHNHEIM (*Zeit. physiol. Chem.*, 1905, 43, 547).—Polemical against Claus and Embden (this vol., ii, 179). This failure to confirm the author's results is attributed to the use of physiological salt solution, which is stated not to be an indifferent reagent like water, but to inhibit ferment action.

W. D. H.

**Relation of Cystin to Sulphur Metabolism.** C. H. ROTHERA (*J. Physiol.*, 1905, 32, 175—182).—Cystin prepared both from hair and from calculi, when given by the mouth in man, is completely oxidised to sulphate, and appears quantitatively as such in the urine. Cholic acid does not diminish this excretion of sulphates in the urine, as it might if cystin were converted into taurocholate. The two forms of cystin used are believed to be identical. Attempts to get the liver to oxidise cystin to sulphate failed. During the preparation of cystin, a purple coloration was observed with ferric chloride and ammonia; it is attributed to cystein, in which, therefore, an  $\alpha$ -thiol-lactic acid nucleus is present.

W. D. H.

**Metabolism of Arginine.** WILLIAM H. THOMPSON (*J. Physiol.*, 1905, 32, 137—146).—From three experiments on dogs, the following conclusions are drawn. Feeding with arginine chloride or carbonate increases the nitrogen of the urine; of the nitrogen so given, from 73 to 96 per cent. reappears as urea. In the body, therefore, ornithine is either not formed or is largely converted into urea. If the arginine is given hypodermically, more nitrogen is excreted than is contained in the arginine; consequently arginine increases nitrogenous metabolism. In one experiment, glycosuria occurred; the cause of this is not clear.

W. D. H.

**A Theory of Protein-metabolism.** OTTO FOLIN (*Amer. J. Physiol.*, 1905, 13, 117—138. Compare this vol., ii, 183).—This is a continuation of the line of argument started by the examination of the urine. The laws governing the composition of the urine are the effects of more fundamental laws governing proteid-katabolism. Voit's theory states that katabolism occurs only in the "circulating proteid." The small amount of living protoplasm which dies is at first dissolved and is so added to the circulating proteid. Pflüger, on the other hand, believes that all proteid is first transformed into living material before katabolism occurs. Schöndorff's experiments in support of this view are inconclusive and can be otherwise interpreted. The chief evidence in favour of Voit's theory is the fact that large quantities of food proteid are katabolised in so short a time. The view taken in this paper is that neither of the two extreme views is correct. Nitrogenous katabolism is of two kinds. One is inconstant and immediate, varies with the food, and leads to the formation of urea, inorganic sulphates, but not of creatinine or "neutral sulphur." The other is smaller in amount, constant in quantity, and is largely represented by creatinine, neutral sulphur, and, to a less extent, by uric acid and ethereal sulphates, and possibly a certain amount of urea. The latter form of metabolism may be termed tissue or endogenous metabolism, whilst the other is exogenous. Endogenous metabolism sets a limit to the lowest level of nitrogenous equilibrium attainable. The proteid sufficient to maintain endogenous katabolism is indispensable; whether the amount exogenously katabolised can be entirely dispensed with is at present questionable, but there is evidence to show that it can largely be replaced by non-nitrogenous food; the nitrogen is easily split off by hydrolysis without oxidation, and thus a non-nitrogenous residue remains available for calorific processes. Urea is absent from the muscles, and its representative creatine is eliminated, not as urea, but as creatinine. The katabolism that terminates in urea formation is not of such fundamental importance as that which leads to the elimination of creatinine. The formation of ammonia and amino-acids which occurs so largely in the intestine, owing to tryptic and ereptic activity, is probably a preliminary means of getting rid of the excess of nitrogen taken in. The evidence that these simple materials are synthesised into tissue-proteids is certainly inconclusive and largely teleological; the formation of urea direct from them by the liver is more probable. The hypothesis that the organism uses proteid if it

can get it, even when fats and carbohydrates are abundant, is also considered to be an unproved assumption. The well-established fact that the organism tends to maintain nitrogenous equilibrium within tremendously wide limits is inconsistent with the teleological argument of albumin formation. An extensive formation of Voit's circulating proteid to be followed immediately by decomposition into urea is quite as improbable as the corresponding formation and decomposition of Pflüger's organised protoplasm.

The organism requires in its food only the small amount of nitrogen necessary for endogenous metabolism; the nitrogen of the extra proteid is unnecessary, and the organism has at hand an active mechanism for immediately casting it out.

In carnivorous animals, the uncertainty of the food supply has led to the development of a capacity to store a proteid reserve in the form of increased muscle substance, but in man this does not exist. Still, that does not mean that the human organism can only replace lost muscle tissue slowly and with difficulty, for in convalescence from disease, recovery of weight is astonishingly rapid. The 118 grams per diem of proteid in standard diets is most excessive, and should largely be replaced by carbohydrates. The argument that most people take as much is of no real value, and might be equally well applied to the daily use of wine. The argument that nitrogenous equilibrium cannot be maintained for long periods on less has been disproved, notably by the recent work of Chittenden (this vol., ii, 179). In disease, where the presence of excess of waste is likely to be more harmful than in health, it is recommended that the intake of nitrogen should be limited to the level of the endogenous requirement (3 to 4 grams daily). The fact that muscular work does not increase proteid katabolism is remarkable if current views on the nature of that katabolism are correct, but it becomes intelligible if proteid katabolism, in so far as its nitrogen is concerned, is independent of the oxidations which give rise to heat or to the energy that is converted into work. Whether severe work will have an effect on the endogenous metabolism cannot be shown by investigating urea excretion; determinations of creatinine and neutral sulphur are necessary for a study of that question. W. D. H.

**Gastric Digestion.** PAUL GRÜTZNER (*Pflüger's Archiv*, 1905, 106, 463—522).—A brief *résumé* of the work done on the mechanism of gastric digestion from the time of Beaumont to the work of Cannon is followed by an account of numerous experiments on animals from the frog upwards. Some attention is directed to the amount of pepsin and acid in the two principal districts of the stomach at varying intervals after digestion has started, but the paper in the main deals with the mechanical aspect of the problem. The pyloric region is the great portion for active digestion and peristalsis; the cardiac half is at first, at any rate, in a resting condition when little or no admixture with gastric juice occurs, but when salivary digestion is unimpeded. The two regions are frequently separated by a band of contraction.

W. D. H.

**Effect of Salt Solutions on Cilia.** SAMUEL S. MAXWELL (*Amer. J. Physiol.*, 1905, 13, 154—170).—One-eighth mol-solutions of the



chlorides of lithium, ammonium, sodium, potassium, magnesium, calcium, strontium, and barium were employed on the ciliated epithelium of the frog's gullet. Sodium chloride is the most favourable to the prolonged life of the cells and the working power of the cilia. The action of the salts bears no direct relation to valency of the cations or to molecular weight. In general, salts of higher solution-tension are more favourable than those of lower, but the agreement is not exact.

W. D. H.

#### Distribution of Potassium in Animal and Vegetable Cells.

ARCHIBALD B. MACALLUM (*J. Physiol.*, 1905, 32, 95—128).—For the microchemical detection of potassium, the following solution is recommended: cobalt nitrite 20 grams, sodium nitrite 35 grams, 10 c.c. glacial acetic acid, and 100 c.c. water. If potassium is abundant the hexanitrite of cobalt and potassium is precipitated as yellow crystals. If the amount of potassium is small, there is only a yellow colour; this is turned black (cobalt sulphide) on the addition of ammonium sulphide. The black coloration forms a very delicate test. The results of the examination of various animal and vegetable cells are described with coloured illustrations. Among these, the following may be mentioned: potassium is found in cell protoplasm, but more abundantly in intercellular material; in striped muscle it is limited to the dim bands, and in pancreatic cells to the granular zone. It is absent from all nuclei and from nerve cells. In nerve fibres, it occurs in curious patches external to the axis, especially at the nodes.

W. D. H.

#### Influence of Salts on the Resting Current of Frog's Muscle.

RUDOLF HÖBER (*Pflüger's Archiv*, 1905, 106, 599—635).—The membrane of muscle fibres, unlike that of blood corpuscles, is in the main impermeable to either anions or cations, even in the presence of carbon dioxide. But a special permeability to potassium ions exists. The cations of the alkalis are arranged in order according to their capability of exciting the ordinary current of rest; the anions may be arranged according to their power to excite a current in the opposite direction. The heavy metals and hydrogen ions excite the resting current; the chlorides of the alkaline earths do not, but produce a sort of coagulation of the membrane. All salts that call forth a resting current stimulate muscle to action.

W. D. H.

**Action of Potassium and Sodium on the Indirect Excitability of Muscle.** FRANK S. LOCKE (*Proc. Physiol. Soc.*, 1904—1905, xxii; *J. Physiol.*, 32).—Overton's statement that the addition of potassium salts to sodium chloride solution hastens the disappearance of indirect excitability is confirmed. This, however, is different from a curare action, which consists in the replacement of tetanus on faradisation by weaker and weaker initial contractions.

W. D. H.

**Muscle of Octopods.** MARTIN HENZE (*Zeit. physiol. Chem.*, 1905, 43, 477—493).—Octopus muscle contains 77.3 per cent. of water and 13.13 per cent. of nitrogen. It is characterised by its richness in taurine. Creatine, creatinine, urea, hexon bases, amino-acids, and glycogen are all absent. Small quantities of hypoxanthine are present,

and another base not yet identified. Sarcolactic acid is often absent, and small quantities of fermentation lactic acid are found. The amount of inorganic salts is greater than in vertebrate muscle, and salts of potassium are more abundant than those of sodium. W. D. H.

**Influence of Meat Diet on the Thyroid and Parathyroids.** CHALMERS WATSON (*Proc. Physiol. Soc.*, 1904—1905, xvi—xvii; *J. Physiol.*, 32; *Brit. Med. J.*, 1905, Jan. 21; *Lancet*, 1905, Feb. 11. Compare Abstr., 1904, ii, 426).—In fowls, excessive meat diet leads to hypertrophy of the thyroid and parathyroid glands. In rats, the effect is usually also fatal; the parathyroids are not affected, but the thyroid generally shows histological changes, which indicate exhaustion of its functions. The question is related to that of gout, and thyroid medication frequently tends to permanent relief. The theory that uric acid is the cause of gout needs revision; the disease is probably infective *via* the alimentary tract; uric acid merely gives the inflammation its specific character. W. D. H.

**Oxidation of Nucleic Acid with Calcium Permanganate. Oxidation and Synthetic Formation of Uric Acid in Extracts of Ox Liver. The Source of Endogenous Purine in Man and Mammals.** RICHARD BURIAN (*Zeit. physiol. Chem.*, 1905, 43, 494—496, 497—531, 532—546. Compare Abstr., 1903, ii, 313, 317; 1904, i, 354, 358, 956).—Kutscher and Seemann were unable to obtain uric acid by oxidising nucleic acid; they therefore doubt its origin from purine bases. This is because calcium permanganate destroys uric acid.

The presence of oxygen is necessary to obtain in liver extract uric acid from the purine bases it contains, or that are added to it. The uric acid found comes almost exclusively from xanthine, and is due to a ferment, xanthine-oxydase. Liver extracts also destroy to some extent uric acid when formed. No evidence of a synthetical formation of uric acid was discoverable.

An analogy is drawn between endogenous and exogenous purine and creatinine in the urine. The formation of creatine and hypoxanthine in muscle is similar, but nuclein- or nucleo-proteid play no part in the origin of either. Muscular hypoxanthine is the main source of endogenous purine in the urine, and its transformation into uric acid is the work of an oxydase. W. D. H.

**Inter-relationship of Calcium and Magnesium Excretion.** JOHN MALCOLM (*J. Physiol.*, 1905, 32, 183—190).—Evidence is adduced to show that the ingestion of soluble magnesium salts causes a loss of calcium in adult animals, and hinders its deposition in young growing animals. Soluble calcium salts do not affect the excretion of magnesium in a similar way. W. D. H.

**Scatoxyl and the Origin of Scatolic Pigments.** LOUIS C. MAILLARD (*J. Pharm. Chim.*, 1905, 21, 187—190).—Largely polemical. A reply to Porcher and Hervieux (this vol., ii, 187). L. DE K.

**Analysis of an Intestinal Gravel.** CHAPUS (*J. Pharm. Chim.*, 1905, 21, 191—192).—The matter contained 23·5 per cent. of mineral matter, mainly consisting of calcium triphosphate and magnesium-ammonium phosphate; carbonates were absent. The organic and volatile portion contained proteids 8·15, fatty matter 3·57, free sterco-bilin 3·37, stercobilin combined with calcium 11·63, cellulose, ammonium salts, &c. Biliary colouring matter could not be detected.

I. DE K.

**Excretion of Water in Typhoid Fever.** TORALD SOLLMANN and J. A. HOFMANN (*Amer. J. Med. Sci.*, February, 1905).—The free administration of water to typhoid patients causes a large polyuria (3 to 9 litres daily). The percentage of chlorides and the total molecular concentration are much below the normal, but the total excretion of dissolved molecules exceeds that in ordinary typhoid cases. The excretion of water and chlorides is nearly parallel to the income, the kidney function being unimpaired. The amount of urine is influenced by the perspiration, and to a less extent by catharsis. Temperature does not directly influence the diuresis. Diuretics, slight nephritis, and calcium chloride have no effect. The excretion of water and chlorides in typhoid fever appears to obey the same laws as in health; there is, however, a greater tendency to chloride retention in the fever, but this is greatly diminished by polyuria. Prolonged restriction of the chloride income produces no deleterious effect; the patients do not develop "salt hunger."

W. D. H.

**The Composition of Caseous Deposits in Tubercle.** E. SCHMOLL (*Chem. Centr.*, 1905, i, 280—281; from *Arch. klin. Med.*, 81, 163—180).—The chief material in tubercular caseous deposits is a coagulated proteid which in composition approaches albumin, globulin, and also fibrin. Any characteristic constituents of cell-nuclei are not detectable. Cholesterol and lecithin are also present.

W. D. H.

**Treatment of Trypanosomiasis by Arsenious Acid and "Trypanroth."** A. LAVERAN (*Compt. rend.*, 1905, 140, 287—291).—Infections with *Trypanosoma gambiense* are in certain species of animals curable by successive treatment with arsenious acid and "trypanroth." The efficacious doses border on the toxic, so the dose advisable for cases in man is difficult to determine.

W. D. H.

**Toxicity of Sea Water on Fresh-water Animals.** WOLFGANG OSTWALD (*Pflüger's Archiv*, 1905, 106, 568—598).—Experiments with sea water in various degrees of dilution on *Gammarus pulex* are represented by curves of toxicity; the males are more resistant than the females. A large number of observations are also recorded in regard to the individual salts, and conclusions similar to those of Ringer, van't Hoff, and Loeb are arrived at.

W. D. H.

**Physical Chemistry of Anæsthesia.** BENJAMIN MOORE and HERBERT E. ROAF (*Thompson, Yates, and Johnston Lab. Report, Liverpool*, 1905, 6, 151—194).—A full account of researches previously published (*Abstr.*, 1904, ii, 501).

W. D. H.



**Effect of Chloroform and Ether on Renal Activity.** WILLIAM H. THOMPSON (*Proc. Physiol. Soc.*, 1904—1905, xxi; *J. Physiol.*, 32).—On the quantity of urine and of nitrogen, the effects of both anæsthetics are very variable. An increase in excretion of chlorides always occurred, especially with chloroform. W. D. H.

**Relation of Enterokinase to Trypsin.** WILLIAM M. BAYLISS and ERNEST H. STARLING (*J. Physiol.*, 1905, 32, 129—136).—Normal rabbit's serum, besides its known antitryptic qualities, sometimes has the power of neutralising or destroying enterokinase. If this power is absent, it may be evoked by repeated injection of enterokinase. The production of antikinase does not increase the antitryptic power of the serum. Injection of trypsinogen does not produce any antitrypsinogen in the serum. The antitryptic power of serum is therefore not due, as stated by Delezenne, to the presence of antikinase. There is also no evidence that a solution of trypsin is equivalent to a combination of kinase and trypsinogen. Trypsin is a new substance produced from trypsinogen by the ferment-like action of enterokinase. The enterokinase does not appear to be essential to, or take any part in, the proteolytic activities of trypsin. W. D. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Biological and Biochemical Studies on Milk.** C. J. KONING (*Milchzw. Zentr.*, 1905, i, 49—68).—A series of experiments is described on the number of bacteria present in fresh milk and in the same milk after 6, 18, 30, 42 or more hours. The results generally show a fall in the number in the early periods, followed by a rapid rise.

N. H. J. M.

**Formation of Volatile Alkaloids in Sterilised Milk by *Bacillus Nobilis*.** Occurrence of such Compounds in Emmen-thaler Cheese. LEOPOLD ADAMETZ and T. CHSZASZEZ (*Milchzw. Zentr.*, 1905, i, 78—80).—Cultures of *Bacillus nobilis* in milk which had been kept 22 months yielded, when distilled, a basic substance *tyrothrisin*, which was obtained from the distillate by extraction with ether. It is a white, crystalline substance having a sharp, characteristic odour, sparingly soluble in water, insoluble in sodium and potassium hydroxides, readily soluble in ether, alcohol, or dilute acids. When treated with ammonia, it forms needles 1—2 mm. long. Phosphomolybdic acid produces a canary-coloured precipitate; phosphotungstic acid a white precipitate readily soluble in an excess. Potassium-mercury iodide yields a precipitate of long, canary-coloured needles. Gold chloride gives a lemon-coloured precipitate which, however, soon decomposes with liberation of gold. Concentrated solutions of picric

acid yield an abundant yellow precipitate. The substance is volatile at the ordinary temperature; a few milligrams kept under a large glass shade almost completely disappear in 36 hours.

The same compound occurs in Emmenthaler cheese.

N. H. J. M.

**Fusel Oil.** HANS H. PRINGSHEIM (*Ber.*, 1905, 38, 486—487. Compare Emmerling, *Abstr.*, 1904, ii, 834).—A red bacillus has been isolated from American potatoes, a pure culture of which ferments potatoes yielding hydrogen, carbon dioxide, and an oil with a strong odour of amyl alcohol and boiling at 112—130°. Distinct spore formation has been observed, and these spores are not destroyed when heated for 10 minutes at 80°. Ten per cent. gelatin at 22° is readily liquefied by the organism. It is not at all certain that the fusel oil obtained in alcoholic fermentation is due to this organism, since its growth and fermentative action are prevented by the addition of 10 per cent. of ethyl alcohol, whilst the formation of fusel oil takes place chiefly towards the close of the alcoholic fermentation, when more than 10 per cent. of alcohol is already present.

J. J. S.

**Resting Yeast in Moist and Pressed Conditions. Action of Foreign Organisms on the Behaviour and Duration of Life of Yeast Cells.** WILHELM HENNEBERG (*Chem. Centr.*, 1905, i, 688; from *Zeits. Spiritusind.*, 28, 1—2, 12, 23, 30, 39, and 48. Compare *Abstr.*, 1903, ii, 168).—The duration of life of yeast is shown to depend on race, temperature, moisture, aëration, and the nature of the infection. Acetic bacteria are the most injurious, and some lactic acid bacteria and *Penicillium* are also injurious. *Oidium lactis* is beneficial, whilst *Pediococcus*, wild yeast, and putrefactive bacteria have no particular effect. Slow drying is favourable, quick drying injurious.

To avoid a considerable infection of yeast, the mash is heated to at least 68°. *Mucor*, *Penicillium*, *Oidium*, putrefactive bacteria, and hay bacilli grow spontaneously in yeast.

N. H. J. M.

**Chemical Reactions occurring during Alcoholic Fermentation.** EDUARD BUCHNER and JACOB MEISENHEIMER (*Ber.*, 1905, 38, 620—630. Compare *Abstr.*, 1904, ii, 199).—The work of other authors bearing on the formation of lactic acid from dextrose and of alcohol from lactic acid is fully discussed. Small quantities of alcohol are conveniently detected by means of *p*-nitrobenzoyl chloride, and this has been made use of to prove that small quantities of alcohol are formed by boiling invert sugar with sodium hydroxide.

Hanriot has shown (*Abstr.*, 1886, 224) that calcium lactate when distilled with lime forms large quantities of alcohol; part of this is now proved to be isopropyl alcohol. isoPropyl *p*-nitrobenzoate crystallises in light yellow prisms melting at 111°. A further series of experiments is adduced to prove that lactic acid is a product of the fermentation of dextrose by pressed yeasts; in the main, however, as much lactic acid is formed in the absence as in the presence of the dextrose.

E. F. A.

**Zymase and Alcoholic Fermentation.** ARTHUR HARDEN (*J. Inst. Brewing*, 1905, 11, 2—13).—A *résumé* of the properties of yeast juice. The paper also includes an account of some of the work carried out by the author (Harden, *Abstr.*, 1903, ii, 319; Harden and Young, *Abstr.*, 1904, i, 543; this vol., ii, 109). A McK.

**Lecithin in Wine.** ANGIOLO FUNARO and I. BARBONI (*Chem. Centr.*, 1905, i, 552; from *Staz. sperim. agrar. ital.*, 1904, 37, 881—897).—Seventeen different samples of wine have been examined for lecithin, and the conclusion is drawn that this is a normal constituent. On the average, 260 mg. of lecithin per litre are present in Tuscany wines. Red wines appear to contain more than white wines. The source of the lecithin is not only the grape seeds, but also the fleshy part of the fruit. There is no connection between the amounts of phosphorus and of lecithin or of alcohol present in a wine. The lecithin is not destroyed when the wine is heated (compare Rosenstiehl, *Abstr.*, 1904, ii, 688; Weirich and Ortlieb, 1904, ii, 304).

H. M. D.

**Composition of Wine Brandies.** XAVIER ROCQUES (*Compt. rend.*, 1905, 140, 511—512).—The brandies of the Charente district contain all the higher alcohols, a large proportion of the aldehydes and esters, and only a very small proportion of the acids of the wines from which they are distilled. The furfuraldehyde, of which traces only exist in the wine, is formed during the process of distillation when the heating is prolonged; thus, a wine which on rapid distillation from a glass vessel gave only 0·3 gram of furfuraldehyde per 100 litres of pure alcohol, gave 4·4 grams when distilled slowly from a copper retort. A summary of the results of analyses of twenty-two specimens of brandy is given in the following table (the results are expressed in grams per 100 litres of alcohol):

	Maximum.	Minimum.	Mean.
Acids .....	37·7	10·0	18·6
Aldehydes .....	33·5	3·8	14·6
Esters .....	213·0	65·9	121·0
Higher alcohols.....	292·1	115·0	211·4
Furfuraldehyde .....	4·4	0·2	2·4
Total, or non-alcoholic coefficient .....	475·6	280·1	367·5
Higher alcohols and esters .....	429·0	235·2	333·9
Ratio, higher alcohols esters .....	4·1	0·7	1·9

M. A. W.

**Assimilation outside the Organism.** CH. BERNARD (*Compt. rend.*, 1905, 140, 509—511).—The opinion has been expressed that the decomposition of carbon dioxide by plants is the result of ferment action. Whilst not denying the possibility, the author has found in repeating and extending former experiments that no evolution of oxygen occurs in sunlight as the result of mixing chlorophyll and extracts of plant tissues. If bacterial decomposition sets in, gaseous products are naturally obtained, but not oxygen. W. D. H.



**Nutrition of Green Plants with Nitrogen.** O. TREBOUX (*Chem. Centr.*, 1905, i, 619; from *Ber. deut. bot. Ges.*, 22, 570—572).

—Nitrogen as nitrites is generally satisfactory as a source of nitrogen in alkaline solutions, but poisonous in acid solutions. The poisonous action of nitrites is only observed when a certain concentration is reached; this concentration is only slightly lower than in the case of ammonium salts. Nitrates have the same, or a greater, nutritive value, whilst ammonium salts are still better. Amino-acids and amides are suitable for lower green plants, but for higher plants the value of amino-acids is much less. Ammonium salts of the corresponding organic acids are generally better than the amino-acids. It is more probable that asparagine and other amino-compounds are decomposed by enzymes with liberation of ammonia than that they are directly employed in the production of proteids. Nitrogen assimilation is independent of chlorophyll. All the plants grew better with heterotrophic than with autotrophic carbon. Mosses can grow without calcium.

Nitrogen as ammonium salts seems to be the best form of nitrogen for chlorophyllous plants, and the intervention of nitrite and nitrate bacteria is unnecessary.

N. H. J. M.

**Leucine and Tyrosine as Sources of Nitrogen for Plants.** L. LUTZ (*Compt. rend.*, 1905, 140, 380—382).—Both leucine and tyrosine were assimilated by *Cucumis vulgaris* and by *Aspergillus niger*, *Aspergillus repens*, and *Penicillium glaucum*.

N. H. J. M.

**Consumption of Odoriferous Substances in Etiolated Plants.** EUGÈNE CHARABOT and ALEXANDRE HÉBERT (*Compt. rend.*, 1905, 140, 455—457. Compare Abstr., 1903, ii, 172, 607).—When kept in the dark, plants are able to utilise the essential oil, and especially terpene compounds. It had previously been observed that etiolated plants contained less essential oil than normal plants.

N. H. J. M.

**Composition and Signification of Aleurone Grains.** SWIGEL POSTERNAK (*Compt. rend.*, 1905, 140, 322—324).—The presence of anhydro-oxymethylenediphosphoric acid (phytine) in aleurone grains has already been observed (Abstr., 1903, ii, 607). An organic acid was also found in the grains of the spruce-fir. The following amounts of total nitrogen and mineral substances were found in the aleurone grains of (1) spruce fir, (2) sunflower, (3) hemp, and (4) white lupin:

	N.	K.	Ca.	Mg.	Fe.	Mn.	P.	S.	Si.
1.	12.97	2.50	0.37	1.25	0.09	0.25	2.67	0.64	0.35
2.	10.22	2.29	0.32	1.46	0.05	trace	2.78	0.64	0.24
3.	12.88	2.71	0.27	1.67	0.03	trace	3.83	0.81	0.36
4.	10.70	—	0.11	0.28	—	0.11	0.61	—	0.01

Sodium and chlorine were not found.

N. H. J. M.

**Amount of Hydrogen Cyanide in the Seeds of *Gynocardia Odorata*.** MAURITS GRESHOFF (*Chem. Centr.*, 1905, i, 683; from *Pharm. Weekbl.*, 42, 102—105).—The pressed seeds yielded 40

per cent. of oil soluble in light petroleum, which, when kept for 24 hours in a closed vessel with water, yielded 0.92 per cent. of its weight of hydrogen cyanide. The fresh seeds probably contain more than 1 per cent. of hydrogen cyanide (compare Power and Gornall, *Proc.*, 1904, 20, 135). N. H. J. M.

**Oil from the Seeds of *Calophyllum Inophyllum*.** GEORG FENDLER (*Chem. Centr.*, 1905, i, 463; from *Apoth. Zeit.*, 20, 6—8).—The seeds contained 22.8—31.5 H<sub>2</sub>O and 50.5—55 oil per cent. The oil has a yellowish-green colour, an odour resembling fenugreek, a bitter taste, and, on keeping, fatty glycerides are deposited. It solidifies at 3°, melts again at 8°, and has a sp. gr. 0.9428 at 15°, Reichert-Meissl number 0.13, saponification number 196.0, acid number 28.45, iodine number 92.8, refractometer number 76 at 40°; it contains 0.25 per cent. of unsaponifiable matter. The increase in weight due to oxygen absorption, when measured by Livache's method, amounted to 0.25, 0.71, 1.32, and 1.84 per cent. after 18, 40, 64, and 136 hours. Treatment with 5 per cent. soda solution removes the resinous constituents. The purified oil solidifies at 4°, melts again at 8°, and has Reichert-Meissl number 0.18, saponification number 191, iodine number 86. The fatty acids of the oil are chiefly palmitic, stearic, and oleic. H. M. D.

**Urea [in Fungi].** RUDOLF GAZE (*Arch. Pharm.*, 1905, 243, 78—79).—Urea (carbamide) was isolated from the fungus *Lycoperdon Bovista* (M. Bamberger and Landsiedl, *Abstr.*, 1903, ii, 567), growing in the neighbourhood of Gersfeld (Rhön), in about equal amount from mature and from immature specimens.

From *Lycoperdon cervinum*, much mannitol could be isolated, but no urea. C. F. B.

**Barley.** EUGEN PRIOR (*Chem. Centr.*, 1905, i, 682; from *Allgem. Zeit. Brauerei Malzfabr.*, 1904. Compare *Abstr.*, 1902, ii, 479).—The amount of water in 49 barleys varied from 10 to 13 per cent., the proteids from 9 to 14 per cent. The nitrogen question can only be settled when the nature as well as the amount of the nitrogenous matters in barley and malt is made clear, and when it is known which substances are useful or injurious for malting. N. H. J. M.

**Pot Experiments [on the Action of Lime and Magnesia] on Barley.** RICHARD ULBRICHT (*Landw. Versuchs-Stat.*, 1905, 61, 357—369. Compare *Abstr.*, 1902, ii, 581).—Application of much dolomite in the spring raised the yield of grain, whilst application in the winter diminished the yield. With a mixture of burnt lime and burnt magnesite, the effect is reversed. N. H. J. M.

**Injurious Action of Crude Potassium Salts on Potatoes.** H. SÜCHTING (*Landw. Versuchs-Stat.*, 1905, 61, 397—449).—Sodium carbonate does not injure potatoes when the amount is 3.4 grams (of Na<sub>2</sub>O) in 19 kilos. of soil. Potatoes which contained the most sodium at the most active period of vegetation gave the highest yields. The

injurious effect of sodium chloride is therefore due to the chlorine. Manuring with sodium salts results in a diminished assimilation of potassium.

During the vegetative period, sodium is distributed equally through the plants; towards the end of the vegetative period, it accumulates in the leaves. When sodium chloride is employed, the excess of chlorine in the leaves during growth migrates later on, in part, to the tubers. Sodium chloride was not found to give rise to a greater retention of potassium in the leaves.

N. H. J. M.

**Estimation of the Fertility and Manurial Requirements of Soils.** JOSEF KÖNIG (*Landw. Versuchs-Stat.*, 1905, **61**, 371—396).—Determinations of the potassium and phosphoric acid of ten different soils, soluble in cold hydrochloric acid of sp. gr. 1.15 and in 1 and 2 per cent. citric acid solutions, gave irregular results, from which the conclusion is drawn that the nutritive constituents occur in very different forms. Further experiments, in which different soils were treated with increasing amounts of soluble manures (potassium and phosphoric acid) and then extracted with 2 per cent. citric acid, showed that some of the manure was retained by the soil.

Comparing the results of pot experiments (with barley) with the amounts of soil constituents dissolved by 2 per cent. citric acid, it was found that the citric acid dissolved far more potassium and phosphoric acid than was taken up by the plants.

N. H. J. M.

**Use of Peat for the Transformation of Calcium Cyanamide into Ammoniacal Compounds.** R. PEROTTI (*Atti R. Accad. Lincei*, 1905, [v], **14**, i, 174—177).—When calcium cyanamide (Kalkstickstoff) is applied as a manure, the vegetation is first of all injuriously affected, but after a time it recovers and grows with increased vigour. The author shows that this is due to hydrolysis of the calcium cyanamide by the soil with the formation of ammonium salts. This hydrolysis is readily effected if the calcium cyanamide is mixed with peat and water. It is suggested that the solution of ammonium salts thus obtained should be used for the hydrolysis of a fresh quantity of calcium cyanamide and that this process be repeated, the final mixture then being very rich in nitrogen.

T. H. P.

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## Analytical Chemistry.

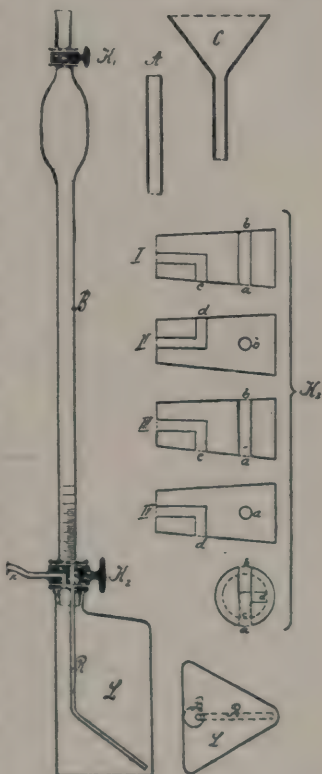
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**Apparatus for Testing Gases.** RUDOLF FIEBER (*Chem. Zeit.*, 1905, **29**, 80).—A compact apparatus, consisting of a gas-burette and four absorption vessels, for the details of which reference must be made to the original paper.

L. DE K.



**Apparatus for Gas Analysis.** V. KARLÍK (*Zeit. Zuckerind. Böhm.*, 1905, **29**, 233—235).—The flask, *L*, contains the absorbent liquid, and ground into its neck is the burette, *B*, which has a content of about 50 c.c. and is divided into 100 parts, the lowest 40 of which are numbered when the apparatus is to be used for the examination of the saturation gases of sugar factories. The cock, *K*<sub>1</sub>, allows the burette to be connected with the space containing the gas to be analysed, whilst the three-way tap, *K*<sub>2</sub>, permits of connection being made between burette and flask (*via* the bent tube, *R*), burette and air or flask and air. *K*<sub>1</sub> is first opened, *K*<sub>2</sub> put in position *I*, and the absorbent solution poured down the funnel, *C* (with ground tube), through the burette into *L*, and finally passes out by the tube, *r*. The latter is then bent upwards so that the space *ab* is filled with the liquid. *K*<sub>2</sub> is now turned into position *II* and the burette rinsed out with water, which also passes out through *r*. The gas under investigation is now passed through the adapting tube, *A*, into the burette and is allowed to flow through for some time before the tap is shut. Where the gas is not under pressure or small in quantity, it is drawn into the burette by suction. *K*<sub>1</sub> being closed, *K*<sub>2</sub> is brought into position *III* and the apparatus arranged horizontally, so that the bent end of the tube *R* points downwards. Part of the liquid now passes into the burette and the amount of this may be increased by careful blowing down the tube *r*. As absorption of the gas takes place, more and more of the liquid enters the burette, and this goes on until absorption ceases; the end of *R* must always be kept underneath the surface of the liquid so that air cannot pass into the burette. When absorption is complete, the apparatus is so inclined that the surfaces of the liquid in the burette and in the flask are in the same plane, and the cock *K*<sub>2</sub> brought into position *III*, and then into position *IV*. The apparatus is then placed vertically and the burette read off. *K*<sub>1</sub> is then opened and *K*<sub>2</sub> put as in *I*, the liquid then flowing from the burette into the flask *L*; in case *ab* is not filled with the liquid, this is effected by inclining the apparatus. *K*<sub>2</sub> is placed in position *II* and the burette washed out with water, after which the apparatus is ready for a new estimation. The apparatus is made entirely of glass and contains no india-rubber or brass connections.



T. H. P.

**Apparatus for estimating Volatile Substances by Loss of Weight.** J. LEHN KREIDER (*Amer. J. Sci.*, 1905, **19**, 188—190).—The apparatus is made from three test-tubes. One retains its ordinary shape; the second is perforated in the bottom with a hole about 1 centimetre in diameter, and fits tightly in the first tube, so that about one-third its length is in the latter. The third test-tube, which fits loosely into the second, is drawn out at the bottom to a capillary tube and closed at the top by a cork, through which passes a tube provided with an india-rubber cap. The hole in the second tube is lightly packed with cotton-wool and the capillary tube passed through it. This second tube is about half-filled with calcium chloride, which surrounds the capillary tube above the hole. The substance to be examined is weighed out into the first test-tube, whilst the reagent employed to liberate the volatile product is drawn up into the third test-tube, as in a pipette, and held there by replacing the india-rubber cap. After fitting the tubes together, the apparatus is weighed. The cap is then removed, when the reagent flows down the capillary tube on to the substance in the lower tube. The volatile product passes through the cotton-wool and calcium chloride and escapes by the narrow space between the sides of the second and third test-tubes. At the end of the operation, a current of dry air is forced through the apparatus before re-weighing. If necessary, the joint between the first and second test-tubes may be made air-tight by means of a little melted wax. The apparatus is suitable for estimating carbon dioxide in carbonates, nitrogen in ammonium salts and urea, &c.

W. P. S.

**Preparation of Volumetric Solutions.** EDWARD C. WORDEN and JOHN MOTION (*J. Soc. Chem. Ind.*, 1905, **24**, 178—182).—Tables are given showing the specific gravities and corresponding percentage strengths of solutions of sulphuric, hydrochloric, and oxalic acids. The tables show differences of 0.0001 in the specific gravities (or 0.005 per cent. of acid), and the fifth decimal place can be readily interpolated. To prepare a normal solution, 27 c.c. of sulphuric acid of sp. gr. 1.84, 95 c.c. of hydrochloric acid of sp. gr. 1.19, or 63 grams of crystallised oxalic acid are dissolved in water to 1 litre. The specific gravity is carefully taken and the exact strength of solution obtained from the tables. A normal factor may then be calculated for the solution.

W. P. S.

**Benzene as Indicator for Iodimetry.** B. SCHWEZOFF (*Zeit. anal. Chem.*, 1905, **44**, 85—88).—The red colour of a solution of iodine in benzene is visible with quantities of iodine too small to produce a distinct blue with starch paste. Benzene may therefore be substituted for starch in iodimetric titrations. The first appearance of the colour when titrating with iodine is more easily observed than its disappearance when titrating with thiosulphate. The titration must be performed in a well-stoppered bottle and with vigorous shaking.

M. J. S.

**Estimation of Perchlorates.** MAX DITTRICH and H. BOLLENBACH (*Ber.*, 1905, 38, 751—752. Compare Lemaitre, *Abstr.*, 1904, ii, 587).—To reduce perchlorates to chlorides, the bottom of a crucible is covered with a layer of sodium nitrite, the sample to be analysed placed on the centre, and a further layer of nitrite added; the mass is then fused and kept so for half an hour at as low a temperature as possible. The perchlorate must not touch the side of the crucible, as otherwise explosions are apt to occur.

The reduction of perchlorates, present in potassium nitrate, on fusion is preceded by the decomposition of the nitrate to nitrite; by adding sodium nitrite, the reduction temperature is lowered, and the risk of loss of chloride is avoided. G. Y.

**Estimation of Small Proportions of Bromine and Chlorine in Iodine.** ROBERT R. TATLOCK and ROBERT T. THOMSON (*J. Soc. Chem. Ind.*, 1905, 24, 187—188).—For estimating small quantities of bromine and chlorine in commercial iodine, the following method is given: 10 grams of the sample are treated with 100 c.c. of water and zinc dust is added in small quantities at a time until all the iodine is converted into zinc iodide. Care must be taken that the temperature does not rise appreciably. The solution is now filtered and 7 grams of pure sodium nitrite are added to the filtrate. By carefully acidifying the solution with dilute sulphuric acid, all the iodine is liberated and almost completely precipitated, but no bromine is set free. The iodine is collected on a filter, washed with water, and the last traces removed from the filtrate by shaking the latter with benzene, this being repeated after adding a little more sodium nitrite and sulphuric acid. The bromine and chlorine are then precipitated as silver salts in the presence of nitric acid, collected on a filter, and washed. The silver chloride is extracted from the precipitate by washing the latter on the filter with a solution of 2 grams of silver nitrate and 10 c.c. of ammonia of sp. gr. 0.88 in 90 c.c. of water. The silver bromide remains insoluble and the silver chloride may be reprecipitated from the ammoniacal solution by the addition of nitric acid. The silver bromide precipitate should always be tested qualitatively for bromine.

W. P. S.

**New Process for Titrating Iodine.** H. HENNECKE (*Chem. Centr.*, 1905, i, 294; from *Pharm. Zeit.*, 1904, 49, 1095—1096).—A reply to a criticism by Jünger (*Pharm. Zeit.*, 49, 1040—1041). The author upholds the validity of his process (*ibid.*, 957), and states that iodine chloride, although liberating iodine from any added sodium iodide, does not act on the iodide formed in the reaction.

L. DE K.

**Volumetric Estimation of Iodine.** H. FRERICHS (*Chem. Centr.*, 1905, i, 561; from *Apoth. Zeit.*, 20, 13—14).—An adverse criticism of the method proposed by Hennecke (*ibid.*, 1904, ii, 1623).

L. DE K.

**Estimation of Sulphur in Coal by Eschka's Process.** CARL BENDER (*Zeit. angew. Chem.*, 1905, 18, 293).—In order to avoid the



influence of the products of combustion of coal gas on the Eschka soda-magnesia mixture, the heating is conducted in a combustion tube open at one end only. L. DE K.

**Apparatus for Absorption of Hydrogen Sulphide in Iron and Steel Analysis.** N. JENNER (*Zeit. angew. Chem.*, 1905, 18, 292).—A vertical five-bulb apparatus, each bulb holding 10 c.c., supported by a glass foot. The upper bulb is connected with a funnel-shaped glass vessel holding 50 c.c. and provided with a spout. L. DE K.

**Evaluation of Sodium Hyposulphite.** ARTHUR BINZ and H. BERTRAM (*Zeit. angew. Chem.*, 1905, 18, 168—170).—Egger's process, titration with potassium ferricyanide with ferrous sulphate as indicator, is recommended (compare Abstr., 1895, ii, 500). L. DE K.

**New Process for detecting Ammonia; Application for characterising the Purity of Waters.** AUGUSTE TRILLAT and TURCHET (*Compt. rend.*, 1905, 140, 374—376).—When solutions of potassium iodide and an alkali hypochlorite are added to a liquid containing ammonia, an intense black coloration is produced due to the formation of nitrogen iodide, and as the same result is obtained when the iodine mono- or tri-chloride and an alkali are used instead of the above reagents, the reaction may be represented by the following equation:  $3\text{ClI} + \text{NH}_3 + 3\text{NaOH} = 3\text{NaCl} + \text{NI}_3 + 3\text{H}_2\text{O}$ . The authors find that no compounds of nitrogen other than ammonium salts form nitrogen iodide under these conditions, and as the reaction is not affected by the presence of proteid matter or alkali sulphides, it forms a more convenient colorimetric test for traces of ammonia in potable waters than the ordinary Nessler test. In applying the test, 3 drops of a 10 per cent. solution of potassium iodide and 2 drops of a concentrated solution of alkali hypochlorite (Eau de Javel) are added to 20 or 30 c.c. of the suspected water; the use of excess of the reagents must be avoided, as nitrogen iodide dissolves under these conditions.

M. A. W.

**Detection of Nitric Acid by the Diphenylamine Reaction.** GUSTAV FRERICHs (*Arch. Pharm.*, 1905, 243, 80).—This reaction can be applied in the following manner, even in the presence of substances such as ferric salts, chromates, &c., which themselves produce a blue coloration.

About 10 c.c. of dilute sulphuric acid are poured over the substance in a test-tube, 20 c.c. of ether added, and the whole shaken. Of the ethereal layer, 2—3 c.c. are filtered into a test-tube, and a grain or two of diphenylamine is added, followed by 5—10 c.c. of concentrated sulphuric acid, when a blue coloration appears if the original substance contains a nitrate.

If the ethereal layer is coloured yellow (iodine, bromine, or chromic acid), it is decolorised by shaking it with a little sulphurous acid, and then a portion is filtered and tested as just described. C. F. B.

**Gravimetric Estimation of Nitric Acid.** MAX BUSCH (*Ber.*, 1905, 38, 861—866).—The very slight solubility of diphenylendoanilo-

dihydrotriazole nitrate in water (this vol., i, 307) makes it possible to precipitate a nitrate quantitatively by means of the base dissolved in 5 per cent. acetic acid; diphenylendoanilodihydrotriazole is sold by Merck under the name "nitron." To precipitate the nitrate to be estimated, 10—12 c.c. of a 10 per cent. acetic acid solution of "nitron" are added to the hot solution (containing about 0.1 gram  $\text{HNO}_3$  per 100 c.c.), to which 10 drops of dilute sulphuric acid have been added; the liquid is cooled for  $1\frac{1}{2}$ —2 hours at  $0^\circ$  and the precipitate collected on a Neubauer crucible, washed with 10—12 c.c. of ice-cold water, and dried at  $110^\circ$ . The precipitate has the composition  $\text{C}_{20}\text{H}_{16}\text{N}_4\cdot\text{HNO}_3$ . The presence of small quantities of chlorides and sulphates does not interfere with the accuracy of the method, but bromides (1 in 800), iodides (1 in 20,000), nitrites (1 in 4000), chromates (1 in 6000), chlorates (1 in 4000), and perchlorates (1 in 50,000) are also precipitated by "nitron." Hydrobromic acid should be previously eliminated by means of chlorine, hydriodic acid by means of an iodate, nitrous acid or chromic acid by hydrazine sulphate. "Nitron" may be used as a qualitative test for nitrates in a dilution of 1 : 60,000.

In order to estimate a nitrate in presence of a nitrite, the solution of the salts (0.2 gram of substance in 5—6 c.c. of water) is added to finely powdered hydrazine sulphate, which completely destroys the nitrite; the nitrate is then precipitated by means of "nitron." Very good results are obtained by this method.

W. A. D.

**Estimation of Nitric Acid in Waters.** FRANZ UTZ (*Chem. Zeit.*, 1905, 29, 177—178).—Frerich's process (Abstr., 1903, ii, 328), evaporation with hydrochloric acid in order to convert the nitrates into chlorides and estimation of the chloride formed, is recommended.

L. DE K.

**Detection of Nitrous and Nitric Acids when occurring together and their Approximate Estimation by means of Diphenylamine.** PAUL N. RAIKOW (*Chem. Centr.*, 1905, 1, 402—403; from *Oesterr. Chem. Zeit.*, 7, 557—561).—Nitrites act instantaneously on diphenylamine dissolved in sulphuric acid, yielding a violet-blue colour which changes to blue and finally fades. Nitrates act much more slowly, but yield in the end a blue solution. Therefore, by suitably diluting a solution, both acids may be detected by their different behaviour.

If a solution of diphenylamine in phosphoric acid is used, the liquid turns blue, due to the nitrite; in the presence of nitrates, characteristic black spots are also noticed.

An approximate estimation of either acid may be made as follows: 0.2 gram of diphenylamine is dissolved in 100 c.c. of pure sulphuric acid or syrupy phosphoric acid of sp. gr. 1.7, and 0.5 c.c. is put into a flat porcelain dish. One drop of the solution to be tested is allowed to run into the acid and the colour is then noticed. By diluting again and again until the reaction is scarcely obtained, an idea may be gained as to the strength of the nitrite or nitrate by the fact that for the sulphuric acid solution the reaction limit is 0.0003 mg. of

potassium nitrate and 0.00005 mg. of potassium nitrite; in phosphoric acid solution, 2.5 mg. of potassium nitrate, but only 0.00006 mg. of potassium nitrite.

L. DE K.

[Volumetric] Estimation of Phosphoric Acid. FRITZ RASCHIG (*Zeit. angew. Chem.*, 1905, 18, 374—376).—The solution, which should contain about 0.15 gram of phosphoric oxide, is precipitated with magnesium mixture. The precipitate is collected at the pump on a small filter and then washed first with 10 and then again with 5 c.c. of plain water. The error due to the solubility of the triple phosphate in plain water may be neglected. The filter with the precipitate upwards is then put into a beaker, 20 c.c. of water are added, and the phosphate is titrated with  $N/10$  hydrochloric acid, using methyl-orange as indicator. A slight excess of acid may be titrated back with  $N/10$  sodium hydroxide. Forty c.c. of  $N/10$  acid = 0.142 gram of  $P_2O_5$ .

L. DE K.

Electrolytic Estimation of Small Quantities of Arsenic. CARL MAI and H. HURT (*Zeit. Nahr. Genussm.*, 1905, 9, 193—199).—The apparatus employed by the authors consists of a wide U-tube in which the decomposition is carried out and a six bulb absorbing tube. Between these two parts, and connecting them, is placed a tube filled with pumice-stone soaked in alkaline lead solution. The electrodes consist of pure sheet lead. The ends of the U-tube are closed with caoutchouc stoppers, through which pass glass tubes, elongations on the lead plates being cemented in these tubes, so that a plate is suspended in each limb of the U-tube. A safety-tube passes through the cork of the anode limb, whilst the cork of the cathode limb is pierced by the capillary stem of a tapped funnel and the delivery tube of the apparatus. The U-tube is about two-thirds filled with a 12 per cent. sulphuric acid solution, and 10 c.c. of  $N/100$  silver nitrate solution are placed in the bulbs of the absorption tube. The current may be obtained direct from the main and should be controlled by a suitable resistance. The solution to be examined is introduced drop by drop from the tapped funnel. Should arsenic be present, the silver solution is darkened, and at the end of 2, or at the most 3 hours, the reduction is completed. The reduced silver is collected on an asbestos filter, washed with a little water, and the excess of silver in the filtrate titrated with  $N/100$  thiocyanate solution. One c.c. of  $N/100$  silver nitrate solution is equivalent to 0.125 mg. of metallic arsenic. For quantities of less than 0.02 mg., the titration method fails and a colorimetric one must be employed, when 0.001 mg. of arsenic may be estimated and 0.0005 mg. detected. For the detection of minute traces, the absorption tube may be replaced by the combustion tube of a Marsh apparatus and a mirror obtained in the usual way.

The authors state that all organic matter must be destroyed before estimating arsenic in such articles as beer, urine, &c.

W. P. S.

Evaluation of Sodium Peroxide. HERMANN GROSSMANN (*Chem. Zeit.*, 1905, 29, 137—138).—A slight modification of the method recommended by Archbutt, namely, decomposition in the presence of a little cobalt nitrate (*Abstr.*, 1895, ii, 185).

L. DE K.



**Employment of Persulphate for Quantitative Separations.**

GEORG VON KNORRE (*Zeit. anal. Chem.*, 1905, **44**, 88—96).—A reply to Dittrich and Hassel (*Abstr.*, 1904, ii, 679; see also ii, 213). In answer to the objection that the author's failure to separate copper completely from manganese was due to the production of precipitates too large for complete washing, it is shown that these quantities were not larger than are commonly obtained in separations; that the manganese precipitate could easily be collected and washed in filters of 9—11 cm. diameter; that the method employed by Dittrich and Hassel to detect copper in the manganese precipitate was not sufficiently sensitive; that even when working with the small quantity (0.1 gram of  $Mn_3O_4$ ) prescribed by Dittrich and Hassel, the manganese precipitate still contained weighable quantities (about 2.6 mg.) of cupric oxide; that repeated dissolution and reprecipitation fail to remove the copper completely, and that even when the precipitate had been repeatedly boiled with 2 per cent. nitric acid until the washings were free from copper, it nevertheless retained about 2 per cent. of copper oxide.

M. J. S.

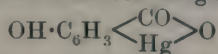
**Solubility of Copper Sulphide in Alkali Polysulphides.**

V. HASSREIDTER (*Zeit. angew. Chem.*, 1905, **18**, 292).—Recent investigations have shown that when copper compounds are fused with sulphur and sodium carbonate, the copper sulphide formed in the reaction is not altogether insoluble in the polysulphide solution. Even copper sulphide formed in the wet way is somewhat soluble in sodium sulphide in the presence of free sulphur.

In order to recover these traces of copper sulphide, the author recommends boiling the solution with cautious addition of sodium sulphite until colourless, sodium monosulphide and thiosulphate being formed which have no solvent action on copper sulphide. L. DE K.

**Estimation of Mercury in Organic Mercury Compounds.**

ERWIN RUPP and PH. NÖLL (*Arch. Pharm.*, 1905, **243**, 1—5).—*Hydrargyrum salicylatum*, to which Dimroth assigns the formula



[CO:OH:Hg=1:2:6], is analysed by boiling it gently for one-quarter to half an hour, until the liquid has become colourless, with 5 c.c. of concentrated sulphuric acid and 4 grams of potassium sulphate (free from chloride) in a flask of 150 c.c. capacity, fitted with a cork and glass tube 40—50 cm. long and supported in an inclined position on wire gauze. The tube is then rinsed down into the flask with 5—10 c.c. of concentrated sulphuric acid and removed; 0.1 to 0.2 gram of potassium permanganate is added to the flask, which is then heated for a few seconds until the colour of the permanganate has disappeared. The liquid is allowed to cool, diluted with water to 100 c.c., and allowed to cool completely; 2 c.c. of iron alum solution are added, and the whole is titrated, with continual and vigorous shaking, with *N*/10 thiocyanate solution, 1 c.c. of which = 0.010015 gram Hg, until the brownish-red coloration appears. The condenser tube is to prevent loss of mercuric sulphate by volatilisation; the permanganate to oxidise the mercurous

sulphate formed. Error in these estimations:  $-0.15$  to  $-0.2$  per cent. of the total amount as estimated gravimetrically.

*Hydrargyrum succinimidatum*,  $(C_2H_4 \begin{smallmatrix} \text{CO} \\ \text{CO} \end{smallmatrix} N)_2Hg$ , can be estimated in the same way. Error:  $+0.3$  to  $+0.4$  per cent. No reactions being known at present for the detection of this substance, the following are suggested:—(1) Heat  $0.1$  gram in a dry test-tube with 5 times its weight of zinc dust, and dip into the vapours a deal splint moistened with concentrated hydrochloric acid; the splint is coloured red (pyrrole reaction). (2) Dilute some 1 per cent. solution of the substance with twice its volume of baryta or lime water; a white precipitate is gradually formed, which turns greyish-black when heated or kept (mercuramino-compound).

C. F. B.

**Estimation of Mercury in Organs.** O. SCHUMM (*Zeit. anal. Chem.*, 1905, 44, 73—85).—The organ is minced, mixed with an equal quantity of water and 1 per cent. of chloroform, and in some cases with pepsin and hydrochloric acid, and maintained at  $37^\circ$  until auto-digestion has taken place. The organic matter is then oxidised by heating with hydrochloric acid and potassium chlorate, and the liquid may then at once be electrolysed without expulsion of the last traces of chlorine. The cathode employed is a piece of electrolytic gold foil,  $3 \times 1$  cm. in area, rolled into a hollow cylinder, to which a fine platinum wire is fused. Electrolysis for 24 hours with an *E.M.F.* of 4 volts precipitates the mercury quantitatively even from 200 c.c. of solution. The cathode is then washed with water, alcohol and ether, dried in a desiccator, and thrust into a tube of hard glass closed at one end. The open end of the tube is drawn out to a capillary, into which the mercury is then distilled. The portion of tube containing the mercury is now cut out with a diamond and weighed. The mercury is then driven off by heat and the tare of the tube ascertained. Should the quantity of mercury be too small for weighing, it may be dissolved from the tube with nitric acid and estimated colorimetrically by adding hydrogen sulphide. Test experiments with  $0.3$  mg. of mercury gave good results. A trace of sulphur is generally found in the capillary, but the quantity is, as a rule, unweighable.

M. J. S.

**Estimation of Oxide of Iron in Pyrolusites.** H. CORMIMBEUF (*Ann. Chim. anal.*, 1905, 10, 51—52).—The powdered ore is ignited in a platinum crucible and then dissolved in hydrochloric acid. The filtrate is partially neutralised with sodium hydroxide and then completely neutralised with pure zinc oxide, an additional 5 grams of which are added. The precipitate is well washed, dissolved in dilute sulphuric acid, and after reducing the iron to the ferrous state with zinc the liquid is titrated with a very weak standard solution of potassium permanganate.

L. DE K.

**Estimation of Tungsten.** GEORG VON KNORRE (*Ber.*, 1905, 38, 783—789. Compare *Chem. Ind.*, 1905, 28, 2).—When an excess of benzidine hydrochloride is added to an aqueous solution of sodium

tungstate, a flocculent, amorphous precipitate of benzidine tungstate is deposited. The precipitation is quantitative and the precipitate can be readily filtered if it is thrown down from hot solutions and allowed to cool, or if deposited from cold solutions in the presence of alkali sulphates.

It is advisable to wash the precipitate with dilute benzidine hydrochloride solution and not with water. The precipitating solution contains 20 grams of benzidine and 25 c.c. of concentrated hydrochloric acid per litre, and the solution for washing is made by diluting this with 30—40 times its volume of water. In all precipitations, an excess of some 20—40 per cent. of the hydrochloride solution is employed. The moist precipitate is ignited in a platinum crucible and the tungsten weighed as trioxide.

In many cases, it is necessary to fuse the tungsten compound with sodium carbonate; the fused mass is then dissolved in water, decomposed by the gradual addition of hydrochloric acid until acid to methyl-orange, 10 c.c. of 0.1*N*-sulphuric acid are then added, and the precipitation completed as before.

Ferrous salts do not interfere with the precipitation, but ferric salts must not be present as they oxidise the benzidine; a considerable excess of free acid should also be avoided, as under these conditions the results are low.

When tungsten-steel is dissolved in hydrochloric or dilute sulphuric acid in the absence of atmospheric oxygen, the whole of the tungsten is left undissolved in the metallic state; this is then ignited, first alone, then with sodium carbonate, and precipitated as described previously. It is not advisable to ignite the metallic residue and weigh directly as trioxide, as small amounts of iron are always present. J. J. S.

**Tin Analysis.** ERNST VICTOR (*Chem. Zeit.*, 1905, 29, 179—181).—Processes are given for the estimation of the impurities generally occurring in commercial tin.

The direct estimation of tin is effected as follows: the sample is dissolved in hydrochloric acid with addition of potassium chlorate and an aliquot part of the solution is heated with a slight excess of reduced iron or aluminium. The filtrate then contains stannous chloride, which is titrated with standard ferric chloride, using as indicator starch and a solution prepared as follows: 10 grams of potassium iodide are dissolved in 10 c.c. of water and 10 grams of hydriodic acid of sp. gr. 1.5, and 3.3 grams of cuprous iodide are added. This solution should be kept a few days before using it; a few pieces of metallic copper may be added to it, and it should be kept in the dark. L. DE K.

**Estimation of Zirconium in Presence of Titanium, especially in Rocks.** MAX DITTRICH and R. POHL (*Zeit. anorg. Chem.*, 1905, 43, 236—241).—The methods generally used for estimating zirconium in presence of titanium are inaccurate when a small amount of one of those elements is present in a mixture containing a relatively large



amount of the other, or when other metals are present in the mixture.

Ammonia was added to a mixture of ferrous ammonium sulphate, titanium nitrate, and zirconium nitrate to which hydrochloric acid and hydrogen peroxide had been added. The resulting precipitate was fused with potassium hydrogen sulphate and the solution of soluble sulphates thus obtained reduced by hydrogen sulphide. To the filtered solution, tartaric acid, ammonia, and ammonium sulphide were added in order to remove the iron completely. After the tartaric acid had been removed, the zirconium and titanium were precipitated together, heated to redness, and weighed. This mixture was then dissolved in potassium persulphate solution and the titanium estimated colorimetrically after the addition of sulphuric acid and hydrogen peroxide.

A mixture of titanium and zirconium salts may also be separated from iron and manganese salts by means of sodium acetate.

A. McK.

**Use of Organic Acids for the Precipitation and Separation of Thorium Dioxide from Cerium, Lanthanum, and Didymium Oxides.** A. KOLB and H. AHRLE (*Zeit. angew. Chem.*, 1905, 18, 92—93).—Cinnamic, benzoic, and salicylic acids, and especially *m*-nitrobenzoic acid, are suitable for the precipitation of thorium salts. When an aqueous solution of *m*-nitrobenzoic acid is added to a neutral solution of a thorium salt, a precipitate, presumably thorium *m*-nitrobenzoate, is formed, the precipitation being complete when aniline is present. Salts of lanthanum and didymium and cerous salts are not precipitated by *m*-nitrobenzoic acid, whilst ceric salts give a yellow precipitate. In order to separate thorium from these other metals, it is accordingly necessary to reduce completely, by means of hydrogen sulphide, any ceric salt present before precipitating the thorium.

A. McK.

**Estimation of Vanadium.** BÉARD (*Ann. Chim. anal.*, 1905, 10, 41—45).—A criticism of the various gravimetric and volumetric processes for the estimation of vanadium.

Berzelius' process (precipitation with ammonium chloride) may be rendered more accurate by adding to the mixture one-third of its volume of alcohol. A new method communicated to the author is as follows: the concentrated alkaline solution containing vanadic or hypovanadic acid is mixed with a large excess of acetic acid and precipitated with excess of nitroso- $\beta$ -naphthol. The precipitate is washed with dilute acetic acid and cautiously ignited. The residue is then dissolved in ammonium carbonate, the filtrate is evaporated to dryness, and the residue calcined. It then consists of pure  $V_2O_5$ .

L. DE K.

**Estimation of Alcohol in Aqueous Solutions by the Freezing Point.** RUFUS GAUNT (*Zeit. anal. Chem.*, 1905, 44, 106—108).—Below 7 per cent. of alcohol, the depression of the freezing point is proportional to the percentage of alcohol, being on the average  $0.425^\circ$  for

each 1 per cent. The estimation can be made with a Beckmann's apparatus in less time than is required for finding the specific gravity.  
M. J. S.

**Direct Estimation of Glycerol.** ALEXIS A. SHUKOFF and PETER J. SCHESTAKOFF (*Zeit. angew. Chem.*, 1905, 18, 294—295).—The solution, which should contain about 1 gram of glycerol, is concentrated on a water-bath to a syrupy consistence, and then mixed with 20 grams of powdered anhydrous sodium sulphate. This absorbs all the moisture, and the glycerol may then be extracted by means of anhydrous acetone in a Soxhlet apparatus. After evaporating the acetone, the residual glycerol is dried at 75—80° to constant weight with the usual precautions.

If the sample should be alkaline, it must be slightly acidified with dilute sulphuric acid and filtered if necessary; the filtrate is then again rendered slightly alkaline with potassium carbonate. Acid samples should also be neutralised. Samples which contain more than 40 per cent. of glycerol need not be concentrated.  
L. DE K.

**Tribromophenol Bromide. Its Detection and Estimation.** S. J. LLOYD (*J. Amer. Chem. Soc.*, 1905, 27, 7—15. See this vol., i, 277).

**Tollens' Phloroglucinol and Hydrochloric Acid Reaction for Pentoses.** ERW. PINOFF (*Ber.*, 1905, 38, 766—771. Compare Tollens, *Abstr.*, 1896, ii, 504).—If Tollens' reaction for pentoses is carried out in alcoholic solution and the liquid then diluted with ether, the absorption band is sharper and the colour is stable in diffused light for some weeks. If less than 1 mol. of phloroglucinol is added for each mol. of pentose, the reaction solution exhibits absorption bands in the red and blue, in addition to that in the yellow parts of the spectrum. As solutions exhibiting any one or two or all three of these absorption bands can be obtained under certain conditions, it is probable that each absorption band is due to the formation of a specific compound.

When a solution exhibiting all three bands is boiled, the band in the red, and on addition of hydrochloric acid and further boiling, the band in the blue, disappears, the absorption band in the yellow gaining in intensity.  
G. Y.

**Estimation of Sugar in Urine.** JOSEF BILINSKI (*Monatsh.*, 1905, 26, 133—141).—A 4 per cent. solution of uranium nitrate is added to 50 c.c. of the urine to be examined until a drop of the mixture colours powdered potassium ferrocyanide brownish-red; the solution is then made up to 100 c.c. with distilled water and filtered; with a part of this solution, preliminary experiments are performed to determine the approximate amount of sugar present in the urine, and if this is found to be less than 0.6 per cent., 0.3 gram of dextrose is added. The solution is then diluted to 5—10 times its volume, and a series of portions, differing from each other by 0.1 c.c., are each heated with 6 c.c. of Fehling's solution and 2—3 drops of the uranium nitrate solution. When the amount of sugar present is equivalent to the

Fehling's solution, the upper layer of the liquid after heating is yellow, and the precipitate is yellow or red, whilst the experiment with 0.1 c.c. more of the urine solution shows a green liquid over a green or dark red precipitate.

G. Y.

**Detection and Estimation of Small Quantities of Maltose in the Presence of Dextrose.** JULIAN L. BAKER and WILLIAM D. DICK (*Analyst*, 1905, 30, 79—83).—The authors find that Grimbert's method (*Abstr.*, 1903, ii, 338) for removing the subsidiary products of the osazone reaction by benzene fails to give satisfactory results owing to the solubility of impure maltosazone. Cold 5 per cent. aqueous acetone removes most of the impurities without dissolving the maltosazone, but by depending on the osazone reaction alone, it is impossible to detect less than 15 per cent. of maltose in mixtures of this sugar and dextrose. Untrustworthy results are also obtained when 20 per cent. acetone is employed.

Small quantities of maltose may, however, be estimated with a fair degree of accuracy by taking the reducing power before and after inversion under standard conditions, which are given. The difference in reducing power may be due to maltose, and to confirm this the solution of the mixed sugars is fermented with *Saccharomyces Marxiannus*, which ferments the dextrose but not the maltose. A fall in the specific rotatory power and a rise in the reducing power give additional evidence of the presence of maltose. The fermented solution may also be treated with phenylhydrazine acetate in the usual way and the osazone formed identified as maltosazone by its microscopical appearance and melting point. Dextrinous substances, if present, must be removed by repeated precipitations with alcohol, or mixtures of alcohol and acetone, before the inversion and fermentation.

W. P. S.

**Analysis of Refined Molasses containing Reducing Sugars.** HENRI PELLET (*Chem. Centr.*, 1905, i, 300; from *Bull. Assoc. Chim. Sucr. et Dist.*, 22, 373—374).—The process given by the author for the estimation of crystallisable sugar, reducing sugars, and dry residue is also suitable for the analysis of molasses from sugar refineries and for mixtures of cane-sugar and beet-sugar molasses. In all cases, the polarisation should be taken both before and after inversion.

L. DE K.

**Estimation of Reducing Substances in Beet-Juice.** HENRI PELLET and L. PELLET (*Chem. Centr.*, 1905, i, 300—301; from *Bull. Assoc. Chim. Sucr. et Dist.*, 22, 374—378).—From 20 to 50 c.c. of the solution, which should not contain more than 3 grams of reducing sugar per litre, are mixed with an equal volume of Fehling's solution and heated in the water-bath to 87°; after heating for another 3 minutes, the liquid is diluted with half its volume of cold water, and the cuprous oxide is collected on a filter, washed with boiling water until free from alkalinity, heated in a muffle, and weighed as oxide. This, multiplied by 0.453, = reducing sugars. Large amounts of cupric oxide are better estimated by titration with stannous chloride



instead of by weighing. If possible, the use of lead acetate in order to clarify the solution should be avoided. If much calcium is present in the liquid, this may be removed by the judicious addition of sodium carbonate.

L. DE K.

**Determination of the Decomposition-Velocity of Nitro-cellulose.** PAUL OBERMÜLLER (*Chem. Centr.*, 1905, i, 472—473; from *Mitt. Berl. Bezirksver. Verein Deutscher Chemiker*, 11/10, 1904).—About 2 grams of the sample, from which the greater portion of the moisture has been removed by pressure, are heated in a small weighed tube placed in a calcium chloride bath, heated at 140°, and connected with a mercury manometer and a special vacuum apparatus. After about 10 minutes, when the remaining water has evaporated, the connection with the pump is broken off and every 15 minutes the pressure is recorded of the gases given off owing to decomposition. Finally, the tube is reweighed and the results are calculated on one gram of the heated substance.

A specimen of good gun-cotton caused a pressure of 19, 41, 66, and 95 mm. in 15, 30, 45, and 60 minutes respectively. In the case of a sample of collodion wool, the pressures amounted to 15, 31, 51, and 75 mm. respectively.

L. DE K.

**Source of Error in the Estimation of Acetone by the Iodoform Process.** WILHELM VAUBEL and O. SCHEUER (*Zeit. angew. Chem.*, 1905, 18, 214—215).—Messinger estimates the amount of acetone by adding potassium hydroxide and then an excess of standard iodine solution, which causes its conversion into iodoform. The excess of iodine is then titrated by acidifying with dilute sulphuric acid and titration with thiosulphate.

The authors state that the process gives satisfactory results provided the iodine is not titrated with thiosulphate, but with standard arsenious acid in the presence of an alkali hydrogen carbonate.

L. DE K.

**Formic Acid and its Volumetric Estimation.** ERWIN RUPP (*Arch. Pharm.*, 1905, 243, 69—73).—The officinal formic acid of the German pharmacopœia can be prepared from the commercial acid, which is now manufactured in a state of considerable purity by the action of carbon monoxide under pressure on powdered sodium hydroxide, &c. This is allowed to remain for a day with a little litharge (1 gram per litre), being shaken frequently; it is then distilled: this is to remove hydrochloric acid. The distillate is diluted to the sp. gr. 1.063, allowed to remain 1 to 1½ days, and then filtered from the slight deposit (of sulphur?).

For the volumetric estimation, a hypobromite solution is prepared by dissolving 15 grams of sodium hydroxide (pure by alcohol) in about 450 c.c. of water in a 500 c.c. flask, allowing to cool, adding 5 c.c. of bromine, shaking until this has dissolved, and diluting to the mark. This solution is standardised by diluting 5 c.c. in a stoppered bottle with 50—75 c.c. of water, adding 20 c.c. of 10 per cent. hydrochloric acid, and, immediately after this, 1 gram of iodine; after 1—2 minutes,

the iodine liberated is titrated with *N*/10 thiosulphate. The hypobromite solution keeps well in a closely-stoppered bottle in the dark; after three months, no appreciable change in strength occurred. For the actual estimation, a suitable volume of this solution is diluted in a stoppered bottle to 70—100 c.c.; a measured quantity of the formic acid is added, sufficient to reduce about half of the hypobromite; dilute hydrochloric acid is added drop by drop until the yellow colour of bromine is just permanent where the drop falls in, and the whole is allowed to remain half an hour in the dark. Then 1 gram of potassium iodide and 10—20 c.c. of dilute hydrochloric acid are added, and the iodine liberated is titrated with *N*/10 thiosulphate. The difference between the volume of thiosulphate solution now used and that equivalent to the amount of hypobromite solution taken measures the amount of formic acid; 1 c.c. = 0.0023 gram  $\text{H}\cdot\text{CO}_2\text{H}$ . Error -0.2 to +0.2 per cent. of the whole, when 11 c.c. is the measure of the formic acid.

C. F. B.

**Detection of Foreign Oils in Nut Oil.** J. BELLIER (*Ann. Chim. anal.*, 1905, 10, 52—59).—Into two test-tubes are introduced respectively 1 c.c. of pure nut oil and 1 c.c. of the suspected sample. Five c.c. of alcoholic potassium hydroxide (16 grams in 100 c.c.) are added, and the tubes are heated nearly to boiling until the fat has dissolved. After closing the tubes, they are placed for half an hour in water at 70° and then mixed with a previously ascertained quantity of acid (1 vol. glacial acetic acid, 3 vols. of water) sufficient to neutralise the alkali. The tubes are then again corked and placed in water at 17—19° and shaken frequently.

Pure nut oil hardly gives a precipitate, but poppy-seed oil, if not present in too small amount, causes an abundant deposit. Other oils, such as olive, sesamé, cotton, pea-nut, linseed, colza, and rape seed, often cause such a deposit that the whole mass appears solid.

L. DE K.

**Detection of Saccharin in Wine.** ED. MACKAY CHACE (*J. Amer. Chem. Soc.*, 1904, 26, 1627—1630).—Fifty c.c. of the wine are extracted in the usual manner with ether and with light petroleum of low boiling point, and the extracted matter, after evaporation of the ether, is again extracted with light petroleum. This extract is returned to the dish containing the residue from the extraction with light petroleum, and, after diluting to 10 c.c., 1 c.c. of dilute sulphuric acid (1 : 2) is added and the mixture heated to boiling. If salicylic acid should be present, an excess of a 5 per cent. solution of potassium permanganate is added and the boiling continued for one minute, but in the absence of this acid there is no need for further boiling. A small piece of sodium hydroxide is now added, the filtrate is evaporated to dryness in a silver dish, and the residue heated for 20 minutes at 210—215°. This converts any saccharin into salicylic acid, which is then tested for as usual.

L. DE K.

## General and Physical Chemistry.

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**Refractive Indices of the Elements.** CLIVE CUTHBERTSON (*Phil. Trans.*, 1905, A. 204, 323—349).—Details are given of work already described (this vol., ii, 129).  
J. C. P.

**Ultra-violet Absorption of Organic Dyes.** PAUL KRÜSS (*Zeit. physikal. Chem.*, 1905, 51, 257—296).—The main classes of substances investigated by the author are the azo-compounds, the derivatives of triphenylmethane, and the components of the azo-dyes. Details are given of the absorption spectra, and the paper is illustrated by a number of plates. The solvents used were water and ethyl alcohol; in some cases, strong sulphuric acid also was employed. The colourless bases and components of the dyes are all characterised by marked ultra-violet absorption bands. The intensity and breadth of the absorption bands of the various dyes are, in general, less in the ultra-violet than in the visible part of the spectrum. The ultra-violet absorption of one group of dyes is characteristically different from that of another group; within a given group, the general character of the absorption remains the same, constitutional differences being revealed by a greater or smaller displacement of the absorption bands. It is thus possible in many cases to settle the group to which a dye belongs by examining a photograph of its absorption spectrum. In the case of the azo-dyes, introduction of methyl groups in the aniline part of the molecule has but slight influence on the position of the absorption bands; substitution, however, in the naphthalene part of the molecule has a much greater effect on the character of the ultra-violet absorption, and the magnitude of the effect depends on the position of the substituent group. It is not permissible to study the absorption of azo-dyes in concentrated sulphuric acid solution, for the latter exerts more than a merely solvent action except when the dyes are already sulphonated. The author's work confirms the view that ultra-violet absorption increases with the number of double bonds in the molecule. The fastness to light of the dyes is no doubt intimately connected with the ultra-violet absorption, but to deduce the relative fastness from the amount of absorption is permissible only with dyes of similar constitution; it is not always the dye showing the strongest ultra-violet absorption which bleaches most rapidly in sunlight, as may be shown especially in the case of the azo-dyes.

The paper contains a review of the work previously done on the absorption spectra of organic dyes.  
J. C. P.

**Phosphorescence caused by the Beta and Gamma Rays of Radium.** Parts I and II. GEORGE T. BEILBY (*Proc. Roy. Soc.*, 1905, 74, 506—510, 511—518).—When canary-yellow crystals of barium platinocyanide are placed on the mica cover of a cell containing radium bromide, the colour changes from yellow to red, and the phosphorescence falls rapidly to about 1/12th of its original value; further, the phos-



phorescence of the reddened crystals ceases immediately on their removal from the action of the rays. The original yellow colour and phosphorescent value are restored completely by recrystallisation of the red crystals; the restoration is not effected by exposure to sunlight, as stated by some observers. It is shown that the reduction of the phosphorescent value accompanying the change from yellow to red is not due to chemical decomposition or to loss of water of crystallisation, and the author propounds the view that it is associated with a change from the crystalline to the amorphous condition (compare Abstr., 1904, ii, 647), a view supported by his experiments. Thus the colour change and the reduction of phosphorescent value may be brought about simply by bruising and flowing the yellow crystals on a glass plate. The amorphous product obtained in this way and the reddened crystals obtained by the action of the  $\beta$ -rays are both reconverted on heating into the yellow state, and the phosphorescent value is raised in both cases.

Very often, as with barium platinocyanide, phosphorescent phenomena may be attributed to physical changes. The molecular movement required to bring about these changes may be produced by heat, by mechanically applied stress, or by radiant energy. Other types of phosphorescence are distinguished by their appearance in three stages: primary, secondary, and revived phosphorescence: primary phosphorescence is the luminescence produced under the direct influence of a stimulus; secondary phosphorescence is the luminescence which continues after the direct stimulation has ceased; revived phosphorescence is the luminescence revived by heat after the secondary phosphorescence has diminished or ceased altogether. In cases where secondary or revived phosphorescence is observed, the effects must be referred to the play of chemical affinity. The author has studied the action of the  $\beta$ - and  $\gamma$ -rays on rock crystal, calcespar, potash glass, flint glass, potassium iodide, bromide, and chloride, specially in reference to the colour changes produced, and the secondary and revived phosphorescence. The observed phenomena support the view that when solids are exposed to the  $\beta$ - or cathode-rays a sort of electrolysis takes place, that the products of electrolytic dissociation are insulated or partly insulated from each other by the neutral molecules, as in a viscous electrolyte, and that it is the breaking down of this insulation and the recombination of the ions which causes revived phosphorescence. Additional experiments at  $-100^{\circ}$  confirm the view that a low temperature increases the insulating power of the molecules, enabling some substances (for example, barium platinocyanide) to store chemical energy which are unable to do so at all at higher temperatures, and increasing the storage capacity of others (for example, potassium chloride and bromide).

J. C. P.

**Theory of Photographic Processes. Chemical Dynamics of Development.** S. E. SHEPPARD and C. E. KENNETH MEES (*Proc. Roy. Soc.*, 1905, 74, 447—473).—The authors' results are summarised as follows: if  $T$  is the optical transparency of the silver deposited in photographic processes, then the density  $D$  (which =  $-\log T$ ) is accurately proportional to the mass of silver. From considerations of the growth

of the density during development and of the theory of heterogeneous reactions, the equation  $1/t \cdot \log D_{\infty} / (D_{\infty} - D) = K$  is deduced, and the experimental results are in harmony with this formula. The velocity of development, as measured by the constant  $K$ , is directly proportional to the concentration of the reducer, is affected by the age and condition of the plate, and is reduced by the addition of soluble bromides, not, however, in the proportion which would occur if the velocity of the chemical reaction  $\overset{+}{\text{Ag}} + \overset{-}{\text{R}} = \text{Ag}(\text{met.}) + \overset{-}{\text{R}}$  alone were measured. It thus appears that the velocity of development depends mainly on the rate of diffusion to the affected haloid. The law of constant density-ratios due to varying exposures, deduced from the above theory, is experimentally confirmed. The development-factor  $\gamma$  in the sensitometry equation  $D = \gamma(\log E/i)$  is governed by the same laws as a single density. Methods for calculating and controlling  $\gamma$  are given, by means of the equation  $1/t \cdot \log \gamma_{\infty} / (\gamma_{\infty} - \gamma) = K$ . By means of this expression, the velocities with ferrous oxalate, fluoride, and citrate were compared, the relative values of  $K$  being in  $N/10$  concentration 0.0487, 0.003, and 0.001.

J. C. P.

**Photographic Activity of Ozone.** KARL SCHAUM (*Chem. Centr.*, 1905, i, 580; from *Physikal. Zeit.*, 6, 73—74).—The variable sensitiveness of gelatin plates to ozonised oxygen, when hydrogen peroxide is absent, is due to differences in the quality of the gelatin.

G. D. L.

**Spontaneous Action of Metals on Sensitive Films of Photographic Plates without Direct Contact.** GEORG W. A. KAHLBAUM and MAX STEFFENS (*Chem. Centr.*, 1905, i, 579; from *Physikal. Zeit.*, 6, 53—60).—Metallic plates, whether submitted or not to radium or X-rays, act on photographic plates. Zinc and aluminium plates, acting on a plate placed above them, lose this power after exposure to X-rays, but act on a plate placed below as before; moisture and heat modify the intensity of the action. Actinoautography appears to result from heavy emanations. Zinc and seemingly aluminium and the radioactive uranium give images on plates placed both above and below, the other metals giving images only on those placed below them.

G. D. L.

**Origin of Radium.** BERTRAM B. BOLTWOOD (*Phil. Mag.*, 1905, [vi], 9, 599—613. Compare *Abstr.*, 1904, ii, 666).—The general method of investigation previously employed (*loc. cit.*) has been extended to twenty-two different samples, comprising twelve distinct mineral species. It is found, in harmony with the earlier work, that the quantities of uranium and radium occurring together are directly proportional. The only possible conclusion is that uranium is the parent of radium. The participation of thorium in the production of radium is excluded by the fact that the radium-uranium ratio is independent of the percentage of thorium in the minerals. It is highly probable, as suggested by Rutherford, that intermediate stages exist between the uranium atom and the

radium atom. The persistent appearance of lead as a constituent of uranium-radium minerals may indicate that this element is one of the final disintegration products of uranium. The only mineral examined by the author which was found practically free from lead was a sample of uranophane from North Carolina. This is geologically the youngest of the minerals examined, and it would naturally contain very little lead if this element was a final disintegration product.

The author's experiments show that monazite from various sources contains 0.3—0.4 per cent. of uranium. The presence of notable quantities of uranium and radium in monazite explains the accumulation of helium in this mineral, for monazite is geologically very old, and the production of helium through radium from uranium has doubtless been going on for countless ages.

J. C. P.

**Radiation from Hydrogen Peroxide.** J. PRECHT and C. OTSUKI (*Chem. Centr.*, 1905, i, 653; from *Ber. Deut. phys. Ges.*, 3, 53—56).—The permeability of various substances for the radiations from hydrogen peroxide was tested photographically and chemically by means of gelatin plates containing titanium dioxide in sulphuric acid. Gelatin, celluloid, paper, and Canada balsam are penetrated, paraffin, ebonite, glass, and metals (including aluminium) are not.

A strong current of air does not prevent some hydrogen peroxide from reaching the plate, and the effect of varying the concentration of the peroxide is in accordance with the law of vaporisation of binary liquid mixtures. The phenomena are due to volatilisation of the peroxide, and not to radiation as supposed by Graetz (*Physikal. Zeit.*, 5, 698).

G. D. L.

**Radiation from Ordinary Materials.** NORMAN R. CAMPBELL (*Phil. Mag.*, 1905, [vi], 9, 531—544).—The author has measured the spontaneous saturation current (or "leak") through vessels of various forms and materials. It appears that the influence which the walls of a containing vessel exert on the spontaneous ionisation of the enclosed air is due to a radiation proceeding from the walls. Part of this radiation from certain materials, such as tin, zinc, graphite, and platinum, is analogous to the secondary radiation excited by Röntgen and other rays. The absorption-coefficient of air for the radiation is comparable with that of air for the  $\alpha$ -radium rays, and is different for different materials. Hence the radiation is not likely to be due to radioactive impurities, but is probably an inherent property of the material. There is no evidence of rays from ordinary materials of a penetrating power considerably greater than that of the  $\alpha$ -rays from radioactive elements.

J. C. P.

**Radioactivity and Chemical Change.** NORMAN R. CAMPBELL (*Phil. Mag.*, 1905, [vi], 9, 545—549).—When a chemical reaction takes place in contact with the outside of a vessel, there is, in general, a change in the spontaneous leak within the vessel. This has been regarded by some investigators as evidence that chemical change is accompanied by radioactivity, but the author shows that the phenomenon is due to the heating of the walls of the vessel. Chemical



actions which develop heat sometimes cause an increase and sometimes a decrease in the leak, but the sign of the change is the same as that of the change due to heat. Chemical reactions which are accompanied by the evolution of gases cause an increase in the leak, but this increase is more readily explained by the ionisation of the gases than by a process of ray-emission. J. C. P.

**Heat Actions of Radium Bromide, Naphthalene, and Camphor.** N. A. HESEHUS (*J. Russ. Phys. Chem. Soc.*, 1905, 37, ii, 1—9).—The actions of naphthalene and camphor on both ordinary and electric thermometers are similar to that of radium, but only about one-third as strong. These observations confirm the conclusion already drawn from previous experiments made by the author and by Georgiewsky (*J. Russ. Phys. Chem. Soc.*, 1903), namely, that the rise of temperature indicated is due mainly to the absorption of the radium emanations by the thermometers themselves. T. H. P.

**Ionisation produced between Parallel Plates by Radium Emanation.** WILLIAM DUANE (*Compt. rend.*, 1905, 140, 786—788).—Air containing radium emanation was introduced into a chamber containing two parallel plates and the ionisation current between the plates for a considerable difference of potential was determined: (1) immediately after the introduction of the emanation, (2) three hours later, and (3) half an hour after the emanation had been removed by a current of air. In the first case, the observed current is due to the emanation, in the second, to the sum of the effects of the emanation and of the imparted activity, and in the third case to the third substance *C* of the imparted activity. Formulæ are given showing the dependence of the current on the distance between the electrode plates in each of the three cases.

Assuming that the charge on an ion is  $3 \times 10^{-10}$  electrostatic units, the maximum number of ions of each sign produced by unit quantity of the emanation per second is  $2.1 \times 10^9$ . It is also calculated that the energy involved in the production of the emanation from radium bromide corresponds with about one-twentieth of the total heat disengaged by the radium salt, and further that 14,500 ions of each sign are produced in the destruction of a molecule of emanation.

H. M. D.

**Photoelectric Phenomena exhibited by Moist Silver Iodide.** HERMANN SCHOLL (*Ann. Physik*, 1905, [iv], 16, 193—237, 417—463).—Silver iodide which is immersed in aqueous salt solutions and exposed to light undergoes, especially in presence of free iodine, a process of dissociation which produces the ions of silver iodide and probably also negative electrons. The latter are much more mobile in the solid silver iodide than electrolytic ions, and impart metallic conductivity to the silver iodide. The dissociation process referred to is induced by light of all wave-lengths, but the extent to which it takes place runs parallel with the absorptive power of the silver iodide. The author's experiments indicate also that the action of light results in the production of a new substance from silver iodide, the production,

however, being unaccompanied by the liberation or absorption of free iodine. This substance also is photoelectrically sensitive, is unstable, and is therefore formed only up to a certain equilibrium concentration, which depends on the intensity and colour of the illumination.

J. C. P.

**Electrical Conductivity and other Properties of Sodium Hydroxide in Aqueous Solution as elucidating the Mechanism of Conduction.** WILLIAM R. BOUSFIELD and THOMAS M. LOWRY (*Phil. Trans.*, 1905, *A*, 204, 253—322).—A full account of work that has been described previously (this vol., ii, 135).

J. C. P.

**Electrical Conductivity of Liquid Ammonia Solutions. II.** EDWARD C. FRANKLIN and CHARLES A. KRAUS (*J. Amer. Chem. Soc.*, 1905, 27, 191—222. Compare Abstr., 1900, ii, 382).—In continuation of the work on this subject, the investigation has been extended to the following substances: formamide, chloroacetamide, cyanoacetamide, phenylacetamide, benzamide, thiobenzamide, phthalimide, cyanamide, sulphamide, nitroamide, methylnitroamine, nitroguanidine, urethane, ammonium nitrourethane, mercury succinimide, sodium nitromethane, tetranitromethane, trinitrobenzene, trinitroaniline, aurous cyanide and the cyanides of potassium, mercury, silver, and zinc, nitrates of lithium, sodium, potassium, thallium, silver, and barium, chlorides of sodium and ammonium, bromides of sodium and ammonium, iodides of sodium, ammonium, and silver, hydrochlorides of ethylamine and diethylamine, and water.

The results of the experiments are tabulated and are also plotted as curves. The specific conductivity of liquid ammonia at its boiling point is below  $0.01 \times 10^{-6}$  Kohlrausch units. The amides are, in most cases, readily soluble in liquid ammonia, and whilst those of the weaker acids have a low conductivity, those of the stronger acids are good conductors; thus a solution of carbamide is scarcely capable of conducting the current at all, that of formamide conducts much better, and those of the amides of the strong sulphonic acids and of nitric and sulphuric acids are excellent conductors. As stated in the previous paper, the nitro-compounds of both aliphatic and aromatic hydrocarbons are generally readily soluble in liquid ammonia, forming solutions which conduct well. Nitromethane unites with ammonia at  $-33^\circ$  to form two crystalline additive compounds,  $\text{CH}_3 \cdot \text{NO}_2 \cdot 2\text{NH}_3$  and  $\text{CH}_3 \cdot \text{NO}_2 \cdot \text{NH}_3$ , both of which lose their ammonia at the ordinary temperature and pressure. Tetranitromethane yields an additive compound,  $\text{C}(\text{NO}_2)_4 \cdot \text{NH}_3$ , but is decomposed by excess of ammonia with formation of ammonium trinitromethane,  $\text{CH}(\text{NO}_2)_3 \cdot \text{NH}_3$ , which dissolves very easily in liquid ammonia to form a solution of good conductivity. The stronger solutions of cyanoacetamide and the cyanides of the heavy metals in liquid ammonia exhibit a decrease of molecular conductivity with increasing dilution; as the dilution is further increased, the conductivity passes through a minimum and then gradually rises. The salts of univalent metals with univalent acid radicles show a great variation in conductivity and degree of

ionisation with the dilution. The behaviour of solutions of these salts in liquid ammonia is compared with the behaviour of their aqueous solutions.

E. G.

**Anodic Decomposition during the Electrolysis of Certain Thallium, Bismuth, and Silver Salts.** MARGRETE BOSE (*Zeit. anorg. Chem.*, 1905, **44**, 237—266).—The products of decomposition at the anode during the electrolysis of aqueous solutions of certain thallium, bismuth, and silver salts have been investigated. The electrolysis was conducted in each case at the ordinary temperature, and with electrodes which were not attacked.

The anodic decomposition curves for thallium nitrate exhibit two decomposition points, of which the higher, corresponding with 1.428 volts, indicates the formation of the oxide  $Tl_2O_3$ , whilst the lower, corresponding with 1.08 volts, also indicates the formation of another oxide, which was formed in small amount only. The curves for thallium sulphate exhibit the higher decomposition point only, thus indicating the formation of the oxide  $Tl_2O_3$ . A characteristic, momentary separation of hydroxide was observed in the liquid whenever a definite tension had been exceeded. The anodic curves for bismuth nitrate solutions exhibit a decomposition point corresponding with 1.86 volts, whilst a bright yellow oxide, probably  $Bi_2O_3$ , is produced. At higher tensions, ozonised oxygen is evolved in considerable amount from the surface of the bismuth oxide. The curves for silver nitrate and for silver sulphate show a very sharp decomposition point, corresponding with 1.573 and 1.53 volts respectively. The difference between the positions of these two points is interpreted as with the thallium salts. The oxide precipitated in each case is identical, and is probably  $Ag_2O_2$ . The interpretation of other authors, that the products which are separated at the anode from solutions of silver nitrate and of silver sulphate are compounds of one or several silver oxides with the corresponding acids, is not correct. The assumption of such compounds is not necessary if the analytical difficulties are considered, and especially since compounds which are electrolytically separated readily retain mechanically small amounts of the liquid from which they are deposited.

The thallium oxide and bismuth oxide which separate appear to be non-conductors, while the silver oxide is a conductor. A. McK.

**Electrostenolysis and Faraday's Law.** THEODORE W. RICHARDS and BURBITT S. LACY (*J. Amer. Chem. Soc.*, 1905, **27**, 232—233. Compare Richards and Stull, *Abstr.*, 1903, ii, 259).—Electrostenolysis, or the deposition of certain metals in capillary tubes during the passage of a current, was first observed by Braun, and an explanation of the phenomenon has been put forward by Coehn (*Abstr.*, 1898, ii, 365).

Experiments are described, the results of which are in accord with Coehn's hypothesis, and prove that the complication of electrostenolytic deposition does not affect the weight of the true cathode deposit or the exact application of Faraday's law.

E. G.



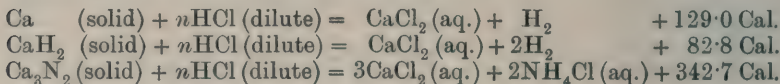
**Modifications of the Thermometer used in the Determination of Molecular Weights and for the Measurement of Small Differences of Temperature.** ERNST BECKMANN (*Zeit. physikal. Chem.*, 1905, **51**, 329—343).—A description of the various modifications, chiefly of the reservoir, that have been tried in the course of evolution of the Beckmann thermometer. The paper is profusely illustrated.  
J. C. P.

**Atomic Heat of Solid Elements.** RUDOLF LAEMMEL (*Ann. Physik*, 1905, [iv], **16**, 551—557).—In depreciating Dulong and Petit's "Law," the author emphasises the variation with temperature of the specific heats of the solid elements. It is suggested, however, that the elements are comparable at their melting points, and it is shown that the atomic heats calculated for these temperatures lie between 9 and 10 calories for a number of elements; there are on the other hand a good many exceptions.

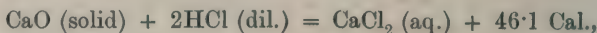
The specific heats of aluminium, chromium, manganese, and lithium have been determined for various temperatures by the author and other workers in the same laboratory. The formulæ expressing the variation of specific heat ( $s$ ) with temperature ( $t$ ) are as follows: aluminium,  $s = 0.208897 + 1.61868t.10^{-4} - 2.94246t^2.10^{-7} + 4.6183t^3.10^{-10}$ ; chromium,  $s = 0.103944 + 1.0591t.10^{-4} - 2.9694t^2.10^{-7} + 5.4088t^3.10^{-10}$ ; manganese,  $s = 0.10722 + 7.8012t.10^{-5} - 1.1085t^2.10^{-7} + 3.8178t^3.10^{-10}$ ; lithium,  $s = 0.7951 + 2.0632t.10^{-3} + 2.5083t^2.10^{-6} + 1.4207t^3.10^{-8}$ .

J. C. P.

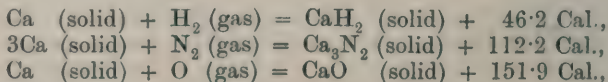
**Heat of Formation of the Hydride and Nitride of Calcium.** ANTOINE GUNTZ and HENRY BASSET, jun. (*Compt. rend.*, 1905, **140**, 863—864).—Electrolytic calcium was purified by distilling in a vacuum, the metal being condensed in a tube of polished iron cooled by a current of water. In these circumstances, the metal was readily obtained in crystalline fragments. The hydride and nitride were prepared by heating in a current of hydrogen or nitrogen, and the following heats of solution were determined:



On the basis of Berthelot's determination,



the heats of formation,

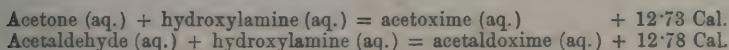


are calculated.

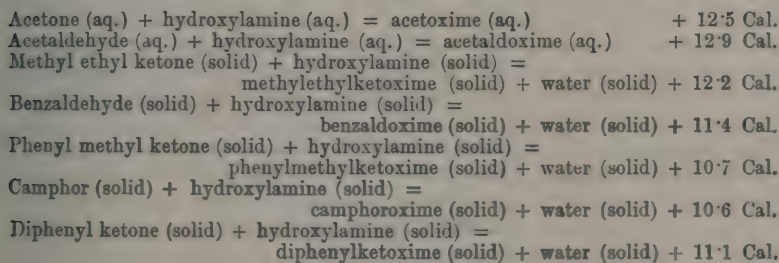
The value given by Thomsen for the heat of formation of calcium oxide is 131.5 Cal. This is 20.4 Cal. smaller than the value calculated by

the authors. Since the heats of formation of the calcium compounds all rest upon this value given by Thomsen, it follows that these heats of formation are very far from being correct. Instead of the heat of formation of calcium carbide being  $-7.25$  Cal., the correct value according to the authors' measurements is  $+13.15$  Cal. H. M. D.

**Heat of Formation of the Oximes.** PH. LANDRIEU (*Compt. rend.*, 1905, 140, 867—870).—The heats of formation of acetoxime and acetaldoxime were determined in the first instance by experiments carried out in aqueous solution, the reaction taking place with sufficient rapidity in alkaline solution :

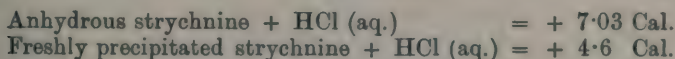


A larger number of data were obtained by measurement of the heats of combustion of the crystalline oximes in the calorimetric bomb, these in some cases being combined with measurements of the heats of solution. The following numbers were obtained in this way :

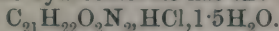


H. M. D.

**Thermochemical Investigation of Strychnine and Brucine.** MARCELLIN BERTHELOT and GAUDECHON (*Compt. rend.*, 1905, 140, 753—761).—*Strychnine*.—Heat of formation from the elements  $+53.6$  Cal. Freshly precipitated strychnine is hydrated and in its transformation into anhydrous strychnine  $3-3.5$  Cal. are developed.



Crystalline strychnine hydrochloride has the composition



It readily loses water at  $120^\circ$ . When dissolved in 75 parts of water, the hydrated salt absorbs  $-5.8$  Cal., whilst the anhydrous salt absorbs  $-1.2$  Cal. The heat of formation of the anhydrous salt is  $\text{C}_{21}\text{H}_{22}\text{O}_2\text{N}_2$  (anhydrous)  $+ \text{HCl (gas)} = \text{C}_{21}\text{H}_{22}\text{O}_2\text{N}_2 \cdot \text{HCl (solid)} + 25.6$  Cal. Normal strychnine sulphate,  $(\text{C}_{21}\text{H}_{22}\text{O}_2\text{N}_2)_2 \cdot \text{H}_2\text{SO}_4$ , forms a hexahydrate and a dihydrate. The acid sulphate,  $\text{C}_{21}\text{H}_{22}\text{O}_2\text{N}_2 \cdot \text{H}_2\text{SO}_4$ , is obtained anhydrous, or as a dihydrate. The heats of dissolution in about 120 parts of water are  $-6.42$ ,  $+3.12$ ,  $+1.29$ , and  $5.33$  Cal. respectively. The heat of formation of the acid sulphate is  $\text{C}_{21}\text{H}_{22}\text{O}_2\text{N}_2$  (anhydrous)  $+ \text{H}_2\text{SO}_4$

(cryst.) =  $C_{21}H_{22}O_2N_2, H_2SO_4$  (anhydrous) + 23.05 Cal. Crystallised strychnine acetate,  $C_{21}H_{22}O_2N_2, C_2H_4O_2, 1.5H_2O$ , does not dissolve completely in water unless excess of acetic acid is present. The heat of solution of the crystalline salt in 120 parts of water is + 3.9 Cal., the heat of solution of precipitated strychnine in dilute acetic acid being + 3.5 Cal.

*Brucine*.—Carefully purified and fractionally precipitated brucine gave numbers on analysis corresponding with the formula  $C_{23}H_{26}O_4N_2$ . On bringing the anhydrous substance into contact with water, an appreciable amount of heat is developed. Brucine precipitated by ammonia from solutions of its salts contains  $4H_2O$ ; 2 mols. are lost on exposure to air at the ordinary temperature, and the remainder is given off at  $110^\circ$  or over sulphuric acid. Brucine is monobasic, but only dissolves in water completely when excess of acid is present. Heat of solution in dilute hydrochloric acid: Anhydrous brucine + 11.2 Cal., Brucine,  $2H_2O$  + 6.8 Cal., Brucine,  $4H_2O$  = + 4.36 Cal.

From an aqueous alcoholic solution of brucine, crystals of the composition  $C_{23}H_{26}O_4N_2, C_2H_6O, 2H_2O$  are obtained. The heat of solution of this compound in dilute hydrochloric acid is + 5.42 Cal. Crystalline brucine hydrochloride,  $C_{23}H_{26}O_4N_2, HCl, 4H_2O$ , loses  $3H_2O$  on exposure to the air at the ordinary temperature. On heating at  $130^\circ$ , the anhydrous salt is obtained. The heats of dissolution in dilute hydrochloric acid are for the tetrahydrate - 6.96 Cal., for the anhydrous salt + 4.36 Cal. Heat of formation of brucine hydrochloride: Brucine (solid) + HCl (gas) = Brucine, HCl (anhydrous) + 23.9 Cal.

Anhydrous brucine hydrochloride absorbs more than four molecules of hydrogen chloride. The quantities of heat developed in the combination of the first, second, third, and fourth molecules are respectively + 23.5, 14.5, 10.5, and 10.4 Cal.

Crystalline brucine sulphate,  $C_{23}H_{26}O_4N_2, H_2SO_4, 6.5H_2O$ , dissolves in dilute sulphuric acid with absorption of - 7.26 Cal. H. M. D.

**Thermal Study of the Acid Function of Pyruvic Acid. Influence of Ketonic Oxygen.** GUSTAVE MASSOL (*Bull. Soc. chim.*, 1905, [iii], 33, 335—337).—The solution of a gram-mol. of liquid pyruvic acid in 2 litres of water develops 4.28 Cal. The solid, crystalline polymeride, obtained by exposure of syrupy pyruvic acid under reduced pressure over sulphuric acid and subsequent stirring with a platinum rod, melts at  $92^\circ$  (pyruvic acid solidified by refrigeration melts at  $13.6^\circ$ ), has the mol. weight 275 (determined cryoscopically in acetic acid solution, in which it is slowly depolymerised), and on solution of a gram. mol. in 2 litres of water absorbs 0.08 Cal., whence the molecular latent heat of fusion = 4.36 Cal., neglecting the small heat of condensation.

When 1 mol. of sodium hydroxide is added to a gram-mol. solution of pyruvic acid in 2 litres of water, 11.80 Cal., and, on the addition of a second gram-mol. of the hydroxide, 1.87 Cal., are developed. The heat of solution of sodium pyruvate is 2.56 Cal., whence the heat of formation of the solid sodium salt from the solid acid is 25.6 Cal. and from the liquid acid 21.24 Cal.

The heat of neutralisation of pyruvic acid is smaller than that of



acetic or propionic acid, whilst the heats of formation of the solid sodium salts of the latter are larger than that of sodium pyruvate.

T. A. H.

**Determination of Some Heats of Mixture.** B. MAY CLARKE (*Chem. Centr.*, 1905, i, 916; from *Physikal. Zeit.*, 6, 154—159).—The heats of mixture of alcohol and water, aniline and xylene, propyl alcohol and water, chloroform and water, xylene and amyl alcohol, chloroform and xylene, and of alcohol and amyl ether have been determined by means of a Bunsen ice calorimeter protected by a Dewar vessel, cotton-wool packing, and a thick layer of ice. In the cases of mixtures of water and alcohol, aniline and xylene, and propyl alcohol and water, the heat toning was found to vary with the change of volume, the maxima on the corresponding curves lying practically at identical positions. This coincidence appears, however, to be accidental, for in other cases, as, for example, that of chloroform and ether, a large heat toning may correspond with a small change of volume.

E. W. W.

**Cryoscopic Measurements with Hydrogen Cyanide.** ROBERT LESPIEAU (*Compt. rend.*, 1905, 140, 855—857).—The lowering of the freezing point of liquid hydrogen cyanide on addition of ethyl alcohol, chloroform, benzene, water, trichloroacetic acid, and sulphuric acid has been measured. The molecular lowering decreases somewhat as the concentration increases, and this decrease is very considerable when the dissolved substance is water or benzene. Extrapolated to zero concentration of the dissolved substance, the value of the molecular lowering is almost the same (19—20) for each of the substances enumerated. In the case of potassium iodide and potassium nitrate, the molecular lowering is almost twice as large (39—40). The observations are compared with the electrical conductivity measurements of Kahlenberg for hydrogen cyanide solutions. Solutions of trichloroacetic acid and sulphuric acid in this solvent are feeble conductors, whereas potassium salts are good conductors, and the author considers that these facts are in accord with the cryoscopic measurements.

H. M. D.

**Joule-Thomson Effect in Carbon Dioxide.** F. E. KESTER (*Chem. Centr.*, 1905, i, 596; from *Physikal. Zeit.*, 6, 44—50).—The results obtained by allowing the gas to pass under pressure through a plug of cotton-wool in an ebonite cylinder are expressible at 22° by the equation  $d\theta/dp = 1.187^\circ + 0.0015 p$ . The variation of  $d\theta/dp$  with  $p$  is greater than would follow from Van der Waals' equation.

G. D. L.

**Apparatus for determining the Specific Gravity of Solid Fats and Waxes.** M. A. RAKUSIN (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 83—85).—This apparatus consists of a light, graduated, stoppered test-tube fitted on a foot and containing from 7 to 15 c.c. From 5 to 10 c.c. of 70 to 90 per cent. alcohol is carefully run into the tube from a pipette or burette, the volume of the liquid accurately

determined, and the whole apparatus weighed. From 1.5 to 2 c.c. of the fat or wax are added in small pieces and the increase of weight and volume measured. The specific gravity of the fat or wax can then be readily calculated. Water may be used in place of alcohol for substances heavier than, and insoluble in, water.

With this apparatus, the specific gravity of cocoanut oil is found to be 0.9702 at 20°. T. H. P.

**Application of Watt's Principle to the Dissociation of the Carbonates of Lead and Silver.** ALBERT COLSON (*Compt. rend.*, 1905, 140, 865—867).—According to Debray's experiments, the reaction  $\text{PbCO}_3 = \text{PbO} + \text{CO}_2$  is not a reversible change. According to the author, white oxide of lead absorbs carbon dioxide readily, but the oxide which results from the decomposition of lead carbonate at 350° has not this property; it has, moreover, a yellow colour and is probably polymerised. When a small quantity of water vapour is introduced into the dissociation apparatus containing the yellow oxide in contact with an atmosphere of carbon dioxide at 180°, the gas is slowly absorbed, especially if the surface of the oxide exposed to the gas is renewed. It is concluded that the decomposition of lead carbonate becomes reversible if the disturbances due to polymerisation of the oxide are eliminated; this appears to be possible in the presence of water vapour. Water vapour is also found to greatly accelerate the establishment of the equilibrium which is ultimately set up when lead carbonate is heated at different temperatures. In a moist atmosphere, the equilibrium condition is reached in 6—7 hours, whereas if the lead carbonate is completely dried by means of phosphoric oxide, this time interval is increased ten to twelve times. The values obtained for the tension of dissociation of lead carbonate (1) in a perfectly dry atmosphere, (2) in an atmosphere saturated with water vapour at a pressure corresponding with 0°, the pressure of the water vapour being corrected for, are as follows:

Temperature:	184°.	210°.	233°.	280°.
(1)	10	32.5	102	548
(2)	12	33	104	

H. M. D.

**Thickness and Tension of the Capillary Layer.** GERRIT BAKKER (*Zeit. physikal. Chem.*, 1905, 51, 344—367. Compare *Abstr.*, 1904, ii, 540).—A mathematical treatment of the relationships existing between the thickness of the capillary layer, the capillary constant, the densities of liquid and of vapour, and the temperature. From the available experimental data, the author concludes that the thickness of the capillary layer for soap solutions at the ordinary temperature lies between 5 $\mu\mu$  and 25 $\mu\mu$ . J. C. P.

**Distribution of Soluble Substances between Water and Aromatic Hydrocarbons.** WALTER HERZ and HERBERT FISCHER (*Ber.*, 1905, 38, 1138—1144. Compare this vol., ii, 79).—Measurements are given of the distribution between water and benzene,

toluene, and the three xylenes, of acetic, chloroacetic, and picric acids, trimethylamine, acetone, and phenol. As acetic and chloroacetic acids form double molecules when dissolved in aromatic hydrocarbons, a constant value was found for the ratio:  $\sqrt{\text{concentration in hydrocarbon} / \text{concentration in water}}$ . This ratio gives a constant value only for concentrated solutions, as the acids tend to become unimolecular in dilute solutions. With picric acid, when allowance has been made for its degree of dissociation in water, the above ratio approaches a constant value with increasing concentration. With phenol, which at first is bimolecular, the constant value above a certain concentration is for the ratio:  $\sqrt[3]{\text{concentration in hydrocarbon} / \text{concentration in water}}$ ; in highly concentrated solutions, in aromatic hydrocarbons, phenol must be therefore trimolecular. The simple ratio,  $\text{concentration in hydrocarbon} / \text{concentration in water}$ , gives constant values for acetone and trimethylamine, these substances not forming or forming but few double molecules.

G. Y.

**Molecular Weight of Salts in Indifferent Solvents.** ARTHUR HANTZSCH (*Ber.*, 1905, 38, 1045—1048).—A solution of dimethylammonium chloride in chloroform is a non-electrolyte; molecular weight determinations were made with difficulty on account of its hygroscopic nature.

By the ebullioscopic method, dimethylammonium chloride was shown never to be unimolecular; in very dilute solution, it is trimolecular, and, with increasing concentration, tends to become quadrimolecular.

A. McK.

**Theory of Colloids. II.** JEAN BILLITZER (*Zeit. physikal. Chem.*, 1905, 51, 129—166).—The principles enunciated in the previous paper (*Abstr.*, 1904, ii, 18; see also *ibid.*, 19) are extended, and their application is tested by a large number of experiments. The relative charges of the colloids may be calculated from the amount of positive or negative ion carried down with each colloid from its solution, and the proportions of two colloids of opposite sign most favourable for their mutual precipitation should then be inversely as their charges (compare Biltz, *Abstr.*, 1904, ii, 324). This is confirmed quantitatively for ferric hydroxide (electropositive) and arsenious sulphide or antimonious sulphide (both electronegative). When the relative quantities of the two oppositely charged colloids are not those referred to, precipitation is incomplete and electrical transport experiments show that the liquid phase contains the colloid added in excess together with a small quantity of the other. Thus, with two colloids, as in the action of electrolytes on hydrosols, a certain minimum concentration must be reached before precipitation will take place. When a trace of gelatin is added to a solution of an electronegative colloid, precipitation by electrolytes is facilitated, that is, a smaller quantity of electrolyte effects precipitation; at the same time, it must be noted that gelatin in larger quantities hinders the precipitation even of an electronegative colloid (compare Neisser and Friedemann, *Abstr.*, 1904, ii, 546). The precipitation of an electropositive colloid in neutral or acid solution is in all cases hindered by gelatin.



With these observations is closely connected the fact that gelatin in neutral or acid solution is electropositive, whilst in alkaline solutions it is electronegative. It appears also that colloidal silicic acid is electronegative in alkaline and faintly acid solutions, but becomes electropositive with increasing acidity. When colloidal silicic acid has been precipitated by barium chloride and a trace of ammonia, the hydrogel is redissolved by hydrochloric acid; when the precipitation has been effected by potassium sulphate and hydrochloric acid, the hydrogel is redissolved by ammonia. Both these observations are associated with the amphoteric character of the silicic acid, which is electropositive or electronegative according to the electrolyte with which it is in contact. Similar observations may be made with such substances as methyl-orange, bismarck-brown, and eosin, which are weak electrolytes with large ions, and behave similarly to colloids in many respects. In all these cases, the hydrogel redissolves when its constituents (the colloid and the accompanying ion), which have originally had charges of opposite sign, become the same in sign through the influence of the added electrolyte.

The author deals on similar lines with the reversible and non-reversible precipitation of egg albumin, and with the phenomenon of agglutination.

J. C. P.

**Pyridine as a Solvent and Ionising Medium for Inorganic Metallic Salts.** JOHANNES SCHROEDER (*Zeit. anorg. Chem.*, 1905, 44, 1—36).—The behaviour of pyridine solutions of mercuric chloride, bromide, iodide, and cyanide, of silver nitrate, sulphate, cyanide, and thiocyanate, of cupric chloride, of ferrous chloride, and of ferric chloride respectively towards various reagents in the absence of water, and towards solutions of metallic salts in pyridine was examined. Mercuric salts combine with pyridine to form double salts of the type  $\text{HgX}_2 \cdot 2\text{C}_5\text{H}_5\text{N}$ . The solubility of mercuric salts in pyridine increases in the sequence chloride, bromide, iodide, and cyanide. Molecular weight determinations of mercuric salts in pyridine, with the exception of mercuric chloride, give values which are too high. The tendency to form complex compounds increases in the sequence chloride, bromide, iodide, and cyanide.

Red mercuric sulphide is precipitated when hydrogen sulphide is passed into solutions of mercuric salts in pyridine. Mercury is deposited when stannous chloride is added to solutions of mercuric salts in pyridine. Mercuric chloride forms a double compound with ammonia and is completely precipitated from its pyridine solution by ammonia. Mercuric bromide undergoes a similar change, whilst the iodide is not entirely precipitated. Mercuric cyanide in pyridine solution does not form a double compound with ammonia.

Molecular weight determinations of silver salts dissolved in pyridine give values which are too high. Silver sulphide is formed when sulphur is added to solutions of silver salts in pyridine.

Ammonia forms the compound  $\text{CuCl}_2 \cdot 4\text{NH}_3$  with cupric chloride in pyridine.

Ferrous chloride in pyridine solution is oxidised to ferric chloride by chlorine, bromine, or iodine. The molecular rise of the boiling

point for pyridine is 28.4. Molecular weight determinations of ferrous chloride in pyridine gave values which were too high.

In many cases, the reactions between dissolved salts and certain reagents took place in pyridine solution just as in water.

A. McK.

### Kinetics of Reactions in Mixtures of Water and Alcohol.

ROBERT KREMAN (Monatsh., 1905, 26, 279—313. Compare Skraup, Abstr., 1894, i, 15; Gennari, Abstr., 1896, ii, 413).—Contrary to Gennari's statement, the hydrolysis of alkyl acetates by sodium hydroxide, in absolute methyl or ethyl alcohol, is a bimolecular reaction and takes place completely. The rate of hydrolysis in methyl alcohol is about one-third of that in ethyl alcohol: the constant for the hydrolysis of ethyl acetate with sodium hydroxide in methyl alcohol,  $k=0.00199$ ; in ethyl alcohol,  $k=0.00540$ ; in propyl alcohol,  $k=0.0213$ ; in *iso*amyl alcohol,  $k=0.1153$ . The presence of small quantities of water affects the rate of hydrolysis in methyl alcohol comparatively slightly; for ethyl acetate in 95 per cent. methyl alcohol,  $k=0.0284$ , whereas in ethyl, and still more in propyl, alcohol solution, the hydrolysis is greatly accelerated: in ethyl alcohol,  $k=0.137$ ; in propyl alcohol,  $k=0.439$ .

As it is difficult to obtain perfectly anhydrous alcohol, it is possible that the greater rate of hydrolysis in the so-called absolute ethyl alcohol over that in absolute methyl alcohol is due to the presence of traces of water, and that in the perfectly anhydrous alcohols the contrary would be the case. It is to be considered also that in solutions of sodium hydroxide in alcohols there is an equilibrium between sodium, hydroxyl, and alkoxyl ions; the differences observed in the rates of hydrolysis in different alcohols may be due to differences in the concentrations of the alkoxyl ions.

In agreement with this, the constant of hydrolysis for ethyl acetate, with sodium methoxide in methyl alcohol,  $k=0.00165$ ; with sodium ethoxide in ethyl alcohol,  $k=0.00221$ ; with sodium propoxide in propyl alcohol,  $k=0.00422$ ; with sodium *iso*amyloxide in *iso*amyl alcohol,  $k=0.0333$ . On the other hand, the constant of hydrolysis with sodium alkoxides is, in proportion to the rate of hydrolysis with sodium hydroxide, much smaller with amyl than with methyl alcohol as solvent; this was to be expected from the decrease in the electro-negative character of the alkoxyl ion with the increase in the molecular weight of the alcohol. When the concentration of the alkoxyl ions becomes extremely small in proportion to that of the hydroxyl ions, as in 50 per cent. or more dilute alcohols, the rates of hydrolysis of the same ester in different alcohols become approximately the same.

G. Y.

**Kinetics of Reactions in Heterogeneous Systems. Hydrolysis in Non-homogeneous Systems.** ROBERT KREMAN (Monatsh., 1905, 26, 315—326. Compare Nernst, Abstr., 1904, ii, 315).—The hydrolysis of ethyl benzoate by sodium hydroxide in absolute methyl alcohol and of amyl acetate by sodium hydroxide in absolute ethyl alcohol are bimolecular reactions. If the hydrolysis takes place in

aqueous solution,  $k$ , for ethyl benzoate, if calculated for a unimolecular reaction, remains constant throughout, whilst with amyl acetate the reaction is at first unimolecular, but towards the end becomes bimolecular. This change in the nature of the reaction, which is due to the mixture becoming homogeneous consequent on the high solubility of amyl acetate, is accompanied by the clearance of the solution.

G. Y.

**Use of the Hot and Cold Tube in the Study of Chemical Reactions.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 140, 905—914).—The author has extended the investigation, initiated by Sainte-Claire Deville, on the detection of reversible chemical reactions which occur only at high temperatures, by using tubes of fused silica, which can be cooled instantaneously from  $1400^{\circ}$  to the ordinary temperature by plunging them into cold water (compare this vol., ii, 316). The quantity of material used in each experiment was small, as the tubes had a mean capacity of 4 c.c., and were filled with gases under diminished pressure, about 40 mm.; the products of the reaction were therefore analysed eudiometrically (compare Abstr., 1889, 301), using reagents capable of detecting 1/500 mg. of a substance. Seventeen experiments are described in the original, nine relating to chemical combination and eight to chemical dissociation; with one exception, namely, the union of diamond and oxygen at  $1325^{\circ}$  to form carbon monoxide and a little carbon dioxide, negative results were obtained in the first series of experiments; oxygen does not condense to ozone at high temperatures, oxygen, nitrogen, and water vapour do not form nitric acid, nor do carbon, graphite, or diamond combine directly with nitrogen or hydrogen. The second series of experiments included the effect of high temperatures on hydrocarbons, cyanogen, and the oxides of carbon: acetylene, methane, and naphthalene are decomposed into carbon and hydrogen (compare this vol., ii, 316), cyanogen is decomposed almost completely into graphite and nitrogen at  $1425^{\circ}$ , at  $1400^{\circ}$  the decomposition is slow, whilst at  $1000^{\circ}$  there is hardly any decomposition; carbon monoxide yields a small quantity of carbon and carbon dioxide at  $1300$ — $1325^{\circ}$  (compare Abstr., 1891, 801), whilst carbon dioxide is quite stable at  $1300$ — $1325^{\circ}$ .

M. A. W.

**Addendum to the Sixth Report of the Committee [of the German Chemical Society] for Fixing Atomic Weights.** HUGO ERDMANN (*Ber.*, 1905, 38, 978—979), HANS LANDOLT (*ibid.*, 1194).—In this Report, Erdmann was erroneously stated to have voted for the exclusive use of the table in which  $H = 1$ . He did not give a vote in favour of any course. Only one vote therefore was given in favour of the  $H = 1$  table (compare this vol., ii, 155).

A. McK.

**Construction of the Periodic System.** ALFRED WERNER (*Ber.*, 1905, 38, 914—921).—The difficulty hitherto experienced of fitting the iron group and the metals of the rare earths into a periodic table of elements is attributed to undue compression of the table and to the attempt to multiply unimportant analogies. Taking into account only the leading characters of the elements, the author deduces a scheme in



which provision is made for eight periods. To the first and second periods, three elements each are allotted; the third and fourth periods have each eight elements (that is,  $3 + 5$ ); the fifth and sixth periods have each eighteen elements (that is,  $3 + 5 + 2 \times 5$ ); whilst to the seventh and eighth periods thirty-three elements each (that is,  $3 + 5 + 2 \times 5 + 3 \times 5$ ) are allotted. It is shown that the mean difference between the atomic weights of two consecutive elements increases from the third period to the sixth, and on this basis the number of elements to be allotted to the other groups is estimated by extrapolation. The first period is so far hypothetical; the second, beginning with hydrogen and ending with helium, contains in all probability a third element not yet discovered. The third period begins with lithium and ends with neon; the fourth begins with sodium and ends with argon; the fifth begins with potassium and ends with krypton; the sixth begins with rubidium and ends with xenon; the seventh and eighth periods have many blanks, but the first member of the former is cæsium, and the second member of the latter is radium. The extra elements inserted in the fifth and sixth periods as compared with the third and fourth, or in the seventh and eighth periods as compared with the fifth and sixth, are regarded as representing a sort of transition series for the elements between which they are inserted. Thus the metals of the rare earths are inserted in the seventh period between barium and the higher homologue of yttrium, and as the characters of these two elements do not markedly differ, the metals of the rare earths are necessarily very similar.

In arranging the elements according to the periodicity of their chemical properties, the author finds it necessary in four cases to invert the order of the atomic weights; thus, (1) argon comes before potassium, (2) cobalt comes before nickel, (3) tellurium comes before iodine, and (4) neodymium comes before praseodymium. It is noteworthy, however, that case (1) falls at the end of the fourth period, whilst case (3) occurs about the end of the sixth period; further, cases (2) and (4) occur 6—7 places later than cases (1) and (3) respectively. There is also considerable analogy between cobalt and nickel salts on the one hand, and neodymium and praseodymium salts on the other.

J. C. P.

**Extraction Apparatus for Large Quantities of Vegetable Powders.** C. E. JULIUS LOHMANN (*Chem. Zeit.*, 1905, 29, 365).—The apparatus consists of a slightly conical cylinder *A*, placed vertically, and provided at the top with a tubulure to which a condenser can be attached; at the bottom, it opens into a small bulb, *a*, and to this again is attached below a tap which terminates in a narrow tube, *b*; surrounding this tube is a wider tube, the side arm of which is connected with the shoulder of the cylinder *A*. A little dry cotton-wool is placed in *a*, the cylinder *A* is filled with 250—500 grams of the powder, and the apparatus attached by the lower tube to a 1500 c.c. flask. After opening the tap, the solvent is poured in from the top until the mass is quite saturated and the liquid begins to run through to the small, slightly drawn-out tube *b*. More solvent is then poured in until the flask is about one-third filled, the tap is closed, and, after connecting the

cylinder with a large condenser, the liquid is heated to boiling on a water-bath or sand-bath. The tap is easily regulated in such a manner that as much liquid runs through *b* as collects on the top; at all events, the mass in *A* must be permanently covered with a layer of solvent. The colour of the liquid as it runs from *b* will generally show the progress of the extraction.

L. DE K.

**Gas Holder with Constant Outflow.** MARIO BETTI (*Chem. Zeit.*, 1905, 29, 219).—An arrangement is described whereby the outflow of gas from the ordinary gas holder is kept constant. The tube, which in the ordinary gas holder dips to the bottom, is replaced by two concentric tubes, soldered together in such a manner that they form a hydraulic valve, which regulates the flow of water into the gas holder, so that the pressure of the gas corresponds with a definite head of water.

A. McK.

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## Inorganic Chemistry.

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**Valency of Hydrogen.** ROBERT DE FORCRAND (*Compt. rend.*, 1905, 140, 764—767).—The assumption that hydrogen is univalent is said to be difficult to harmonise with known facts. These can be more readily explained if hydrogen is assumed to be bivalent, in which case the valencies of all the elements will be doubled. The existence of subhaloid salts and suboxides ( $\text{Ag}_2\text{F} + \text{Ag}_4\text{O}$ ), of compounds such as iodine trichloride and sulphur hexafluoride, of double salts such as those formed by the alkali haloids, and, in general, of the so-called molecular compounds, is referred to in support of the author's contention, and it is shown that simple graphic formulæ can be ascribed to a number of these compounds on the assumption of the bivalency of hydrogen.

H. M. D.

**Precision attained in the Determination of the Atomic Weights of Hydrogen and Nitrogen.** ANATOLE LEDUC (*Compt. rend.*, 1905, 140, 717—718).—The values obtained by the author for the atomic weights of hydrogen (compare Abstr., 1899, ii, 354) and nitrogen (compare Abstr., 1897, ii, 549) are in close agreement with the recent determinations of Guye, Mallet, Bogdan, Jaquero, and Pintza (compare Abstr., 1904, ii, 392, 475, 557, 812).

M. A. W.

**Atomic Weight of Iodine.** ALBERT LADENBURG (*Annalen*, 1905, 338, 259—262).—A reply to Köthner's criticisms (compare following abstract, Abstr., 1903, ii, 360; 1904, ii, 556, and this vol., ii, 81).

K. J. P. O.

**Atomic Weight of Iodine.** PAUL KÖTHNER (*Annalen*, 1905, 338, 262—265).—A reply to Ladenburg (preceding abstract).

K. J. P. O.

**Normal Basicity of Alkali Periodates.** FÉDERICO GIOLITTI (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 217—220).—Periodic acid is monobasic towards sodium hydroxide when helianthin is used as indicator. By means of the electrometric method of Böttger (*Abstr.*, 1898, ii, 89), periodic acid is found to be dibasic. T. H. P.

**Hydrogen Fluoride. I and II.** ERNST DEUSSEN (*Zeit. anorg. Chem.*, 1905, 44, 300—340, 408—430).—Determinations of the strength of hydrogen fluoride by the action of its aqueous solutions in the inversion of cane-sugar showed that hydrofluoric acid is a weak acid. In concentrated solutions, it is somewhat stronger than chloroacetic acid; in the dilution of 1 mol. to 4 litres, both these acids are equally dissociated, whilst in more dilute solutions the dissociation of hydrogen fluoride increases more slowly than does the dissociation of chloroacetic acid. In the dilution of 1 mol. of hydrogen fluoride to 1000 litres, the acid is about half dissociated. Those results were also confirmed by determinations of electrical conductivity. Hydrogen fluoride has about the same strength as phosphoric acid; it is neither a definite monobasic nor a dibasic acid. The amount of hydrogen fluoride in an aqueous solution can be estimated by means of sodium or potassium hydroxides with phenolphthalein as indicator and with the use of conductivity water. Traces of sulphuric acid or of hydrofluosilicic acid are readily detected in solutions of hydrogen fluoride. By aid of the results quoted, the purity of any given sample of hydrofluoric acid may readily be determined.

Spohr's results on the inversion of sucrose by hydrofluosilicic acid are inaccurate. Polarimetric determinations of solutions containing hydrogen fluoride are readily made if the glass discs in the polarimetric tube are replaced by discs of fluorspar. At high temperatures, determinations may be made with tubes of platinum, fluorspar, or copper, although it is observed that platinum at elevated temperatures inverts a solution of sucrose to a slight extent.

According to the author's experience, the introduction of hydrofluoric acid into the sugar industry is likely to meet with little success.

An aqueous *N*/1 solution of commercial ammonium fluoride contained at 25° no measurable amount of hydrogen ions.

Hydrofluoric acid is recommended for freeing iron materials from rust.

By the action of concentrated hydrofluoric acid on an excess of copper oxide, a sparingly soluble oxyfluoride is produced.

For the separation of much aluminium oxide from little ferric oxide, fusion with hydrogen potassium fluoride is recommended.

The titration of ferrous iron by permanganate is inexact in the presence of hydrofluoric acid. A. McK.

**Preparation of Oxygen.** GEORGE F. JAUBERT (D.R.-P. 157171).—Oxygen may be obtained from bleaching powder in the cold by the simultaneous action of a ferrous or manganous salt and a copper, nickel, or cobalt salt. No decomposition of the hypochlorite is effected by iron, manganese, or copper salts alone. The bleaching powder is best mixed to a cream with water, and the most favourable results



are then obtained by adding ferrous and copper sulphates. The reaction may be carried out under pressure if required. The oxygen obtained is pure and free from chlorine.

C. H. D.

**Solubility of Sulphur in Benzyl Chloride and some Properties of these Solutions.** JOSEF JURI VON BOGUSKI (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 92—99).—Sulphur dissolves in benzyl chloride, and on cooling a hot saturated solution the sulphur separates in rhombic crystals. The solubility of the sulphur increases from 1 per cent. at 0° to 55.8 per cent. at 134°. In benzyl chloride, sulphur melts at 106.2—106.8° and does not mix with the excess of solvent, but above 136° sulphur and benzyl chloride mix in all proportions. Solubility curves and tables are given.

T. H. P.

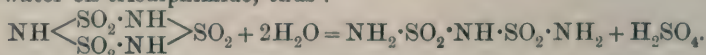
**Composition of the Lime, Sulphur, and Salt Wash.** JOHN K. HAYWOOD (*J. Amer. Chem. Soc.*, 1905, 28, 244—255).—Chiefly an investigation of the reactions taking place when a mixture of sulphur and calcium hydroxide is boiled for different periods with water and salt. The sulphur in its various combinations was estimated by the usual methods. The free sulphur extracted by carbon disulphide was converted into potassium sulphate by boiling with potassium hydroxide with addition of hydrogen peroxide (Avery's process). Sodium chloride has no influence on the reaction between sulphur and calcium hydroxide. For the technical details, the original article should be consulted.

L. DE K.

**Apparatus for preparing Liquid Sulphur Dioxide.** BÉLA KRÉCSEY (*Chem. Zeit.*, 1905, 29, 310).—An elongated glass vessel holding about 100—150 c.c. is furnished with a gas delivery tube reaching to the bottom of the reservoir and an exit tube; each tube is provided with a tap. The vessel is surrounded by a freezing mixture composed of salt and snow and a current of sulphur dioxide is admitted. As soon as a convenient quantity of this has condensed, both taps are closed and the apparatus is put into a cold place. If a current of sulphur dioxide is wanted at the lecture table, the exit tube is opened, but if some of the liquid is required, the tap of the inlet tube is turned.

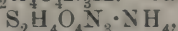
L. DE K.

**New Products from the Action of Ammonia on Sulphuryl Chloride.** ARTHUR HANTZSCH and BERNHARD C. STUER (*Ber.*, 1905, 38, 1022—1043. Compare this vol., i, 317).—Trisulphimide is not known in the solid form. Indications of its transient formation in anhydrous solvents, such as ethyl acetate, were noted. The product previously described by Hantzsch and Holl (*Abstr.*, 1902, ii, 14) as trisulphide is *iminosulphonamide*,  $\text{NH}_2 \cdot \text{SO}_2 \cdot \text{NH} \cdot \text{SO}_2 \cdot \text{NH}_2$ , produced by the action of water on trisulphimide, thus:

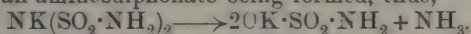


In the preparation of iminosulphonamide, silver trisulphimide is decomposed by anhydrous hydrogen cyanide and not by hydrogen sulphide, as formerly effected by Hantzsch and Holl (*loc. cit.*), whilst

ethyl acetate is used as the crystallising agent. Iminosulphonamide is readily decomposed at  $0^\circ$  by water, thus,  $\text{NH}_2 \cdot \text{SO}_2 \cdot \text{NH} \cdot \text{SO}_2 \cdot \text{NH}_2 + \text{H}_2\text{O} = \text{SO}_2(\text{NH}_2)_2 + \text{OH} \cdot \text{SO}_2 \cdot \text{NH}_2$ , sulphonamide and aminosulphonic acid being formed. The electric conductivity of aqueous solutions of iminosulphonamide gives values corresponding with those for aminosulphonic acid, the sulphonamide also produced by the action of water on iminosulphonamide not being an electrolyte. Iminosulphonamide is moderately stable towards alkalis; it acts as a monobasic acid, forming salts of the type  $\text{S}_2\text{H}_4\text{O}_4\text{N}_3\text{M}$ . The ammonium salt,



was prepared. When iminosulphonamide is gradually added to an excess of an aqueous solution of alkali, the salt first formed gradually decomposes, one-third of the total nitrogen being evolved as ammonia and an aminosulphonate being formed, thus,



It is not certain, however, whether the metal is attached to nitrogen in the formulæ of such alkali salts.

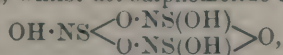
Silver iminosulphonamide,  $\text{NAg}(\text{SO}_2 \cdot \text{NH}_2)_2, 1\frac{1}{2}\text{H}_2\text{O}$ , prepared by the addition of iminosulphonamide to an excess of silver carbonate or of silver oxide suspended in water, is not acted on by cold concentrated aqueous potassium hydroxide with the formation of ammonia; it separates from a mixture of ether and pyridine in stellate crystals. When acted on by acids, it forms molecular amounts of aminosulphonic acid and sulphonamide. It is formed in small amount during the preparation of silver trisulphimide. It is sometimes formed in rhombohedra (possibly a second modification of the salt).

The gelatinous product obtained by Hantzsch and Holl (*loc. cit.*) by the action of ammonia on sulphuryl chloride in solution in light petroleum is difficult to free completely from ammonium chloride, and is probably ammonium aci-sulphomelide,  $\text{S}_3\text{O}_3\text{N}_3(\text{ONH}_4)_3$ .

Barium aci-sulphomelide,  $(\text{S}_3\text{O}_6\text{N}_3)_2\text{Ba}_3, 5\text{H}_2\text{O}$ , is easily soluble in strong acids, sulphomelide being formed.

Cyamelide is formed when dry ammonia is passed into a solution of carbonyl chloride in light petroleum at  $0^\circ$ , no melanurenic acid being produced.

Whilst cyamelide does not form salts, sulphomelide has been obtained only in the form of its salts. The constitution of sulphomelide is discussed in comparison with that of cyamelide (compare this vol., i, 331). The formula  $\text{NH}:\text{SO} \begin{smallmatrix} \text{O} \cdot \text{SO}(\text{NH}) \\ \text{O} \cdot \text{SO}(\text{NH}) \end{smallmatrix} > \text{O}$  is assigned to sulphomelide, whilst aci-sulphomelide has the formula



the former being the *pseudo*-acid and the latter the true acid.

Just as trisulphimide is more easily decomposed than cyanuric acid, sulphomelide is more readily decomposed than cyamelide.

A. McK.

**Constitution of some Nitrogen Sulphonic Acids.** ARTHUR HANTZSCH (*Ber.*, 1905, 38, 1043—1044).—The author does not agree with certain conclusions of Haga and of Divers respecting the con-

stitution of several sulphonic acids containing nitrogen (compare Hantzsch and Semple, *Abstr.*, 1896, ii, 95 ; Haga, *Proc.*, 1903, 19, 281 ; Divers, *Proc.*, 1903, 19, 283 ; *Trans.*, 1895, 67, 1098). A. McK.

**Pure Nitrogen from Nitrous and Nitric Oxides and Ammonia.** GREGORY PAUL BAXTER and CHARLES H. HICKEY (*Amer. Chem. J.*, 1905, 33, 300—304).—Pure nitrogen can be readily obtained in large quantities by the interaction of nitric or nitrous oxide and ammonia at a high temperature. In the case of nitric oxide, the following method is employed. The gas, generated by the action of nitric acid of sp. gr. 1.2 on copper turnings, is led through a wash-bottle containing strong ammonia solution, and afterwards over hot copper gauze or thoroughly platinised asbestos. The nitrogen thus obtained is passed through dilute sulphuric acid, and afterwards over fused potassium hydroxide, through a tower containing glass beads moistened with strong sulphuric acid, and finally through a small tube containing a roll of red-hot copper gauze. It is found that the sp. gr. of ammonia solution used for this purpose must not be higher than 0.92.

In the case of nitrous oxide, the gas obtained by heating ammonium nitrate is passed over red-hot platinised asbestos, then into a wash-bottle containing strong ammonia solution, and again over heated platinised asbestos. The purification of the nitrogen is effected as in the former case. E. G.

**Synthetical Preparation of Ammonia.** WESTDEUTSCHE THOMASPHOSPHAT-WERKE, G.M.B.H. (D.R.-P. 157287).—The synthetical preparation of ammonia from nitric oxide and hydrogen in the presence of platinum black according to the equation  $2\text{NO} + 5\text{H}_2 = 2\text{NH}_3 + 2\text{H}_2\text{O}$  has not hitherto been possible on a technical scale, the presence of carbon monoxide in the Dowson gas or water-gas used leading to the production of ammonium formate. When, however, the temperature is kept below  $80^\circ$  by artificial cooling, ammonia is obtained. The reaction is greatly accelerated by the influence of the dark electric discharge, and a suitable apparatus for the purpose is described. C. H. D.

**Electrolytic Oxidation of Ammonia.** ERICH MÜLLER and FRITZ SPITZER (*Ber.*, 1905, 38, 1188—1190).—Polemical. A reply to Traube (this vol., ii, 242). A. McK.

**Electrolytic Reduction of Nitrates to Nitrites.** ERICH MÜLLER and FRITZ SPITZER (*Ber.*, 1905, 38, 1190—1194. Compare *Abstr.*, 1904, ii, 116).—In the electrolytic reduction of nitrates to nitrites, it is convenient to use cathodes coated with spongy copper, and for this purpose the copper ammonium salt is added to the alkaline solution ; small amounts of copper are accordingly precipitated in the course of the electrolytic reduction.

The authors have examined the question as to the concentration of the nitrite when the latter is reduced to ammonia to such an extent



as to render the production of nitrite from nitrate of no commercial value.

In the experiments quoted, varying amounts of sodium nitrite were added to solutions of sodium nitrate, and, after the current had passed for a certain time, the alteration of the amount of nitrite in the solution estimated. The irregular results obtained indicated that small amounts of some compound influenced the reduction. In certain cases, the nitrite used contained lead.

In order to ensure that the nitrite is not oxidised to nitrate, the concentration of hydroxyl ions in the solution is maintained at a definite value, no diaphragm being used.

A. McK.

**Preparation of Yellow Arsenic by means of the Electric Arc.** ALFRED STOCK and WERNER SIEBERT (*Ber.*, 1905, 38, 966—968).—A solution of the yellow variety of arsenic (compare this vol., ii, 25, and Erdmann and Unruh, *Abstr.*, 1903, ii, 73) is most readily prepared by passing a current of about 12 amperes between a carbon anode and a cathode consisting of an alloy of equal parts of arsenic and antimony, both electrodes being immersed in carbon disulphide contained in a vessel surrounded and covered by water and ice, the arsenic under these conditions dissolving in the carbon disulphide in the form of the yellow modification, whilst the antimony is disintegrated but does not enter into solution. After a sufficient quantity has dissolved, the carbon disulphide is separated from the water and filtered, and may be concentrated by distillation.

W. A. D.

**Use of Arsenic Oxide in the Catalysis of Sulphur Trioxide.** ERNST BERL (*Zeit. anorg. Chem.*, 1905, 44, 267—299).—The author has investigated the velocity of the reaction  $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ , where arsenic oxide was used as the catalyst.

At temperatures ranging from 300° to 500°, glass is attacked by sulphur trioxide. The observation of Lunge and Reinhardt (*Abstr.*, 1904, ii, 724) that arsenic oxide is as good a catalyst as ferric oxide is confirmed; its catalytic power at first diminishes and then attains to a constant value. Mixtures of sulphur dioxide and oxygen were partially dried by sulphuric acid and the amount of moisture best suitable for the action was estimated. When the gases were dried by phosphoric oxide, the velocity of the reaction was diminished and became less the longer the drying was conducted. The presence of too much water in the mixture of gases dried by sulphuric acid is more harmful than prolonged drying with phosphoric oxide. The reaction proceeds in two stages, the first a process of diffusion and the second the process of chemical union (Nernst and Brunner). The determination of the temperature-coefficients gave within the temperatures examined, namely, 310° to 510°, the value 1.4 to 1.1 for every 10° rise of temperature, whereby the process of diffusion appears to proceed more slowly than the process of union. Sulphur trioxide exerts a strong inhibiting effect on the velocity of the action. Carbon dioxide has a similar effect. The presence of an excess of either of the reacting gases increases the rate of combination.

A. McK.

**Preparation of Silicides, Borides, Aluminides, &c.** EDWARD JÜNGST and RUDOLF MEWES (D.R.-P. 157615).—Difficultly fusible metallic haloids, such as calcium or barium chloride or fluoride, magnesium chloride, or potassium chloride, are fused in an electric furnace with such metals or non-metallic elements as form volatile haloid compounds with development of heat. Silicon, boron, aluminium, iron, phosphorus, chromium, and tin are available for this purpose; carbon cannot be employed, its chloride being endothermic. Thus calcium chloride and silicon yield calcium silicide and silicon tetrachloride; calcium chloride and iron yield calcium ferride and ferrous chloride.

C. H. D.

**Use of Quartz Vessels in the Laboratory.** FRANZ MYLIUS and ADOLF MEUSSER (*Zeit. anorg. Chem.*, 1905, 44, 221—224).—Quartz vessels are not acted on by water at temperatures up to 100°; the electrical conductivity remaining unaltered. The action of various alkalis was examined. Barium silicate was formed by the action of baryta water in the absence of air on a quartz vessel, maintained at 18° for six months. Dilute acids, with the exception of hydrofluoric acid, do not appreciably attack quartz vessels at temperatures up to 100°. Concentrated sulphuric acid at 18° and at 100° has no appreciable action. Phosphoric acid at 400° has a strong corroding action. The quartz vessels absorb certain dyes from their solutions.

The use of quartz vessels is recommended for physical or analytical work where neutral or aqueous acid solutions are dealt with.

A. McK.

**Vessels of Fused Silica—their Use in Chemistry. Permeability of Vessels of Fused Silica.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 140, 817—820, 821—825).—Details of the methods of manipulation of fused silica tubes are communicated in the first paper. In the second, experiments are described which show that fused silica is permeable to oxygen, nitrogen, and hydrogen at a temperature of 1300°. In one such experiment, a tube of 4 c.c. capacity was filled with pure oxygen at a pressure of half an atmosphere, the tube being then sealed and heated at 1300° for an hour and a half. After cooling, the tube was found to contain 3 c.c. of nitrogen. Another tube of 5 c.c. internal volume was filled with hydrogen at a pressure of one-fifth of an atmosphere and heated at 1300° for one hour. The gas extracted from the tube after the experiment consisted of 0.68 c.c. of hydrogen and 0.12 c.c. of nitrogen, measured at atmospheric pressure. A considerable amount of hydrogen has thus escaped from the tube, the original volume measured at atmospheric pressure being equal to 1.0 c.c. When naphthalene was heated in an exhausted fused silica tube at 1300°, carbon was deposited, and the hydrogen escaped almost completely through the walls of the tube. The volume of gas contained in the tube after heating for one hour at 1300° was only 0.18 c.c. (instead of 14 c.c. if all the hydrogen in the naphthalene had been liberated and retained), and analysis showed this to consist of 0.15 c.c. of hydrogen and 0.03 c.c. of nitrogen. Phenomena of the

same nature were observed when methane was heated in a fused silica tube. H. M. D.

**Silicic Acid.** III. EDUARD JORDIS (*Zeit. anorg. Chem.*, 1905, **44**, 200—208. Compare Abstr., 1903, ii, 364, 475).—It is impossible to obtain pure silicic acid in the hydrosol form. The only silicic acid which can be obtained pure is the solid. Attempts to prepare a pure hydrogel of silicic acid are described. A. McK.

**Solubility of Potassium Chloride, Bromide, and Iodide in Water.** ADOLF MEUSSER (*Zeit. anorg. Chem.*, 1905, **44**, 79—80).—The solubility of potassium chloride, bromide, and iodide respectively in water was determined from temperatures about 10° to the eutectic point. A. McK.

**Composition of an Ancient English Gunpowder.** LOYS DESVERGNES (*Ann. Chim. anal.*, 1905, **10**, 102—103).—A bomb found among débris in Saint Martin de Ré (France), and probably used by the English besieging army in 1627, contained a moist powder which, after drying and allowing for the 17·2 per cent. of rust it contained, consisted of nitre 38·5, sulphur 23·5, and charcoal 38 parts. A former English gunpowder consisted of nitre 75 parts, sulphur 10 parts, and charcoal 15 parts. If, like the above specimen, such a sample has been subjected to leaching until only 38·5 of nitre remains, the sulphur and charcoal would then have become respectively 24·5 and 37, which are practically the figures found. L. DE K.

**Sodamide.** FRITZ EPHRAIM (*Zeit. anorg. Chem.*, 1905, **44**, 185—199).—A study of the action of sodamide on inorganic substances. When sodamide is added to a solution of sulphur in xylene and the mixture heated, ammonia, nitrogen, sodium, and ammonium polysulphides and a substance rich in nitrogen are formed. When bromine is added to benzene containing sodamide in suspension, the action is represented by the equation  $4\text{NaNH}_2 + 3\text{Br}_2 = 4\text{NaBr} + \text{N}_2 + 2\text{NH}_4\text{Br}$ . The reaction proceeds less vigorously when iodine is substituted for bromine. Sodamide acts vigorously on magnesium, hydrogen being evolved and a mixture of magnesium nitride and sodium being produced. Sodamide has no action on iron, tin, copper, and silver.

A number of oxides were heated with sodamide. Lead monoxide was reduced to lead; copper oxide and cadmium oxide were also reduced. With mercuric oxide, an amalgam was formed. Antimony trioxide gave sodium antimonite and antimony. Reduction also took place with arsenic trioxide, chromic anhydride, chromium trioxide, ferric oxide, manganese sesquioxide, manganous oxide, zinc oxide, tungstic acid, and vanadium pentoxide.

Lead sulphide was reduced to lead and copper sulphide to copper. Bismuth sulphide yielded an alloy of bismuth and sodium. The action on antimony sulphide, arsenic sulphide, copper sulphate, lead sulphate, and sodium sulphate was also examined.

The chlorides of lead, mercury, silver, tin, zinc, and barium were also reduced to the corresponding metals. Calcium chloride and potassium chloride did not act on sodamide.



Copper phosphate was reduced to copper and ferric phosphate to iron.

When lead nitrate and sodamide were rubbed together in a mortar, the mixture deflagrated; the action with silver nitrate was similar. Bismuth nitrate, when heated with sodamide, formed an alloy.

A mixture of potassium chlorate and sodamide exploded when heated. Lead borate yielded lead. Ferric hydroxide, cadmium hydroxide, and other metallic hydroxides were converted into the corresponding oxides. A. McK.

**Sodium Hyposulphite.** ARTHUR BINZ (*Zeit. Farb. Text. Ind.*, 1905, 4, 161—162).—When turmeric paper, moistened with a slightly alkaline solution of sodium hyposulphite, is exposed to the air, it loses the brown colour due to the alkali without bleaching taking place. It appears that an acid salt is formed, a fact which is more readily explained by assuming Bernthsen's equations: (1)  $\text{Na}_2\text{S}_2\text{O}_4 + \text{O} = \text{Na}_2\text{S}_2\text{O}_5$ ; (2)  $\text{Na}_2\text{S}_2\text{O}_5 + \text{H}_2\text{O} = 2\text{NaHSO}_3$ , than by accepting Schützenberger's formula for sodium hyposulphite. The structure of the latter substance is discussed at some length (compare Bernthsen, this vol., ii, 240; Bazlen, *ibid.*, ii, 240; Reinking, Dehnel, and Labhardt, *ibid.*, i, 261). W. A. D.

**Preparation of Hyposulphites.** M. BILLY (*Compt. rend.*, 1905, 140, 936—937).—The author finds that sodium hyposulphite cannot be prepared by the action of sulphur dioxide on sodium in the presence of a neutral solvent such as ether or light petroleum (compare Badische Anilin- & Soda-Fabrik, Abstr., 1904, ii, 250); in the presence of absolute alcohol, however, both sodium and magnesium are readily converted into the corresponding hyposulphite by the action of sulphur dioxide; it is probable that traces of the metallic ethoxide and hydride are first formed; the latter reacts with the sulphur dioxide to form the hyposulphite regenerating hydrogen, which converts a fresh portion of the metal into the hydride (compare Moissan, Abstr., 1903, ii, 75). The formation of Nabl's zinc hyposulphite is similarly explained (compare Abstr., 1900, ii, 13).

M. A. W.

**Normal Sodium Thiophosphate, containing Water of Crystallisation.** EMANUEL GLATZEL (*Zeit. anorg. Chem.*, 1905, 44, 65—78).—Normal sodium thiophosphate,  $\text{Na}_3\text{PS}_4 \cdot 8\text{H}_2\text{O}$ , prepared from sodium monosulphide, phosphorus pentasulphide, and water, forms transparent, monoclinic crystals, which are decomposed at the ordinary temperature by water, hydrogen sulphide being evolved. When the dry salt is heated, hydrogen sulphide is also evolved and a yellow mass remains. A. McK.

**Absorption Compounds of Colloidal Silver and Other Inorganic Colloids with Organic Colloids.** ALFRED LOTTER-MOSER (*J. pr. Chem.*, 1905, [ii], 71, 296—304).—For the preparation of colloidal silver, the isolation of protalbic or lysalbic acid is unnecessary, as the liquid hydrosol is formed by reduction of ammoniacal

silver nitrate solutions containing egg-albumin, serum-albumin, or casein. A colloidal silver, similar to Paal's preparation (Abstr., 1902, ii, 500), is formed by boiling an ammoniacal solution of silver nitrate and egg-albumin with sodium hydroxide. On addition of silver nitrate to a solution of starch in dilute sodium hydroxide, the hydrosol of silver oxide is formed; this is reduced to colloidal silver on prolonged boiling, or quickly on treatment with formaldehyde. The hydrosol so obtained is very stable and does not give a precipitate with nitric, sulphuric, or acetic acid; on addition of hydrochloric acid, a precipitate of silver and silver chloride is formed. The brown, solid hydrosol, precipitated by alcohol or by a large excess of glacial acetic acid, dissolves slowly in water. Liquid hydrosols are formed from aqueous silver nitrate, also by the action of alkaline dextrin, gelatin, agar-agar solutions, or powdered hide. Liquid and solid hydrosols of silver haloids are formed by the same reagents.

The liquid hydrosol, formed by heating starch with aqueous sodium hydroxide, reacts, after neutralisation with acetic acid, towards iodine in the same manner as does ordinary starch solution. The deep blue solid hydrosol, which is precipitated on addition of alcohol, loses iodine slowly when washed with alcohol or ether, and changes into a brown, granular substance, which contains iodine, as it dissolves in water to a blue solution. The blue colloid loses its colour when heated, and becomes blue again, not on cooling, but on solution in water.

G. Y.

**Relationships between the Solubility of Calcium Sulphate and the Hydration of Gypsum and of Portland Cement.** PAUL ROHLAND (*Zeit. angew. Chem.*, 1905, 18, 327—330).—The results obtained by Jones and Getman (Abstr., 1904, ii, 386) on the existence of hydrates in concentrated solutions of electrolytes throw light on the solubility of calcium sulphate at varying temperatures.

In determinations of the solubility of calcium sulphate in water, the size of the calcium sulphate particles is an important factor on which the rate of hydration of calcium sulphate is also dependent. The substance undergoing hydration must first pass into solution before hydration takes place. From the fact that both calcium sulphate semihydrate and anhydrous calcium sulphate first pass into solution before hydration occurs, the conclusion is drawn that, before the solubility product is exceeded, hydrated molecules are present in solution. Calcium sulphate exhibits even in dilute salt solutions a maximum which corresponds with a maximum of the rate of hydration.

A. McK.

**Formation of Oceanic Salt Deposits. XLI. Temperature of Formation of Potassium Pentacalcium Sulphate.** JACOBUS H. VAN'T HOFF, GERARDUS L. VOERMAN, and WALTER C. BLASDALE (*Sitzungsber. K. Akad. Wiss. Berlin*, 1905, 12, 305—310).—The formation of potassium pentacalcium sulphate according to the equation  $K_2Ca(SO_4)_2 \cdot H_2O + 4CaSO_4 \cdot 2H_2O \rightleftharpoons K_2Ca_5(SO_4)_6 \cdot H_2O + 8H_2O$  has been previously described (Abstr., 1904, ii, 561), and the equilibrium temperature was found to lie between 83° and the ordinary temperature. Tensi-

metric observations gave the value  $31.8^{\circ}$  for the equilibrium temperature and 34.7 mm. for the equilibrium pressure. By the addition of tartaric acid, the temperature is lowered to  $-2.2^{\circ}$  and the pressure to 2.87 mm., from which the pressure at other temperatures is calculable. A diagram illustrating the field of the pentasulphide is given; the field is small at  $25^{\circ}$ , but increases with rise of temperature.

L. M. J.

**Action of Ultra-violet Light on Glass.** FRANZ FISCHER (*Ber.*, 1905, 38, 946—947).—Various kinds of glass have been exposed to ultra-violet rays from a quartz-mercury lamp, the short space between the quartz and glass being filled with hydrogen. Jena combustion glass, durax glass (Schott), German lead glass, and English lead glass were not affected, whereas ordinary Thuringian glass, apparatus glass from Greiner, apparatus glass from Bock and Fischer, and normal thermometer glass (Schott) were coloured strongly violet within 12 hours. All the latter contained manganese, whereas the glasses which were not discoloured were free from manganese.

The violet colour is readily destroyed by heating the glass until it softens.

J. J. S.

**Complexity of Glucinum.** CHARLES L. PARSONS (*J. Amer. Chem. Soc.*, 1905, 27, 233—237).—Pollok (*Trans.*, 1904, 85, 1630) has stated that the beryl of Limoges contains a new element which resembles glucinum in its chemical properties but has a much higher equivalent.

The results of Pollok's experiments are discussed and it is suggested that they may have been produced by the presence of moisture, which causes a rapid decomposition of glucinum chloride with loss of chlorine. For this reason, the opinion is expressed that Pollok's results cannot be regarded as proving the existence of a new element in the beryl until it is shown that moisture was carefully excluded from the chloride used in his experiments.

E. G.

**Alloys of Magnesium and Lead.** G. GRUBE (*Zeit. anorg. Chem.*, 1905, 44, 117—130).—The author has examined the curve of cooling of mixtures of magnesium and lead to see whether a compound is formed. The temperatures were determined by a thermo-element, of which the one wire consisted of platinum and the other of an alloy of platinum and rhodium.

Antimony melts at  $620^{\circ}$ , zinc at  $412^{\circ}$ , lead at  $327^{\circ}$ , and magnesium at  $651^{\circ}$ .

When varying weights of lead and magnesium are melted together, only one compound,  $\text{PbMg}_2$ , is formed, provided that the temperature does not exceed  $750^{\circ}$ . This compound separates at  $551.3^{\circ}$ . The curve shows two eutectic points, where the percentage of lead is 67 and 97 respectively, corresponding with the temperatures  $459.2^{\circ}$  and  $246.9^{\circ}$ .

The compound is brittle, steel-blue in colour, and stable in dry air. In moist air, it is quickly decomposed to form a black powder, from which a hydrate corresponding with the formula  $\text{PbO}, 2\text{MgO}, 3\text{H}_2\text{O}$  is produced.

A. McK.



**Zinc Chloride. Solubility of Salts. XIV. FRANZ MYLIUS and RUDOLF DIETZ** (*Ber.*, 1905, 38, 921—923. Compare Dietz, *Abstr.*, 1899, ii, 221).—Zinc chloride has been obtained in the anhydrous and in five hydrated modifications, containing 1,  $1\frac{1}{2}$ ,  $2\frac{1}{2}$ , 3, and 4  $\text{H}_2\text{O}$  respectively. The existence of a hydrate containing  $2\text{H}_2\text{O}$  is not confirmed. The solubility curve consists of seven branches, the progressive conversion of the anhydrous salt into its hydrates is reversible. A 52 per cent. solution of zinc chloride does not solidify at  $-62^\circ$ , whilst at  $75.5^\circ$  the solution yields a eutectic mixture which melts at  $0^\circ$ ; concentrated solutions form a brittle, glassy mass when strongly cooled. Seven different systems, in which the saturated solutions contain 67.5—81 per cent. of zinc chloride, are capable of existence at  $0^\circ$ ; at this temperature, a transition from one form to another containing more water of crystallisation is accompanied by a diminution in the concentration of the saturated solution, by an increase in the solubility of the crystalline substance, and by a diminution of the excess of the solvent over the water of crystallisation of the solute. G. Y.

**Revision of the Atomic Weight of Cadmium. Analysis of Cadmium Chloride.** GREGORY P. BAXTER and MURRAY A. HINES (*J. Amer. Chem. Soc.*, 1905, 27, 222—231).—The cadmium chloride used in these experiments was prepared in the following manner. Cadmium sulphide, prepared by fractional precipitation, was converted into the nitrate, and the nitrate into the sulphate. The sulphate was submitted to electrolysis, the cadmium thus obtained was dissolved in pure hydrochloric acid, and the chloride was converted into the double ammonium salt. The cadmium ammonium chloride was purified by fractional crystallisation, two fractions of pure material being thus obtained. A third sample of material used in the analyses was a portion of that employed in the determination of the sp. gr. of cadmium chloride (*Abstr.*, 1904, ii, 257). Each of these specimens was converted into cadmium chloride by ignition in a current of dry hydrogen chloride.

In the first series of analyses, the ratio of cadmium chloride to silver chloride was determined by the addition of a slight excess of silver nitrate to a solution of the cadmium salt, the precipitated silver chloride being collected, washed, dried, and weighed; the silver chloride dissolved in the washings was estimated by precipitating it with excess of silver nitrate, the precipitate produced being compared by means of the nephelometer (Richard and Wells, *Abstr.*, 1904, ii, 287) with that yielded by standard solutions of hydrochloric acid.

In a second series of experiments, the weight of pure silver required to combine exactly with the chlorine in cadmium chloride was determined by dissolving a weighed quantity of pure silver in nitric acid and adding the diluted solution to that of the cadmium chloride. Portions of the solution were tested from time to time in the nephelometer for excess of chlorine or silver and, if necessary, standard silver nitrate or hydrochloric acid was added until the amounts of chlorine and silver in the solution were equivalent.

The value for the atomic weight of cadmium obtained as the average result of the first series, consisting of three experiments, was 112.476,

whilst the average of the six determinations of the second series was 112.462, the average of the whole of the results being 112.469 ( $\text{Ag} = 107.93$ ;  $\text{Cl} = 35.473$ ).  
E. G.

**Preparation and Properties of Manganese Boride.** EDGAR WEDEKIND [and K. FETZER] (*Ber.*, 1905, **38**, 1228—1232).—A crystalline regulus containing about 82 per cent. of manganese is formed when boron and manganese thermite are brought together and the mixture ignited with magnesium powder (Goldschmidt process). The small excess of manganese and boron is removed as chloride by heating the powdered mass in a stream of chlorine and washing quickly with ice-cold water. The greyish-black, glistening, crystalline *manganese boride*,  $\text{MnB}_2$ , contains 71.7 per cent. of manganese; it is slowly decomposed by water and dilute acids and has a sp. gr. 6.04 at  $19^\circ$ .

A manganese boride,  $\text{MnB}$ , containing 82.2 per cent. of manganese, very similar to the above in appearance and properties, is obtained on heating manganese suboxide and boron in the electric furnace (compare Binet du Jassoneix, this vol., ii, 90).  
E. F. A.

**Oxidation of Metals in the Cold in presence of Ammonia.** CAMILLE MATIGNON and G. DESPLANTES (*Compt. rend.*, 1905, **140**, 853—855).—The metals in finely divided condition were shaken up at the ordinary temperature in large flasks containing 10 c.c. of ammonia solution (255 grams per litre) for periods varying from 24 to 60 hours. In the majority of cases, blank experiments were made in which the metals were similarly shaken with distilled water.

In the presence of ammonia, nickel, cobalt, silver, cadmium, zinc, molybdenum, tungsten, and mercury are oxidised; with tin and chromium, no action takes place.  
H. M. D.

**Dibromotetra-amminecobalt Salts.** ALFRED WERNER and A. WOLBERG (*Ber.*, 1905, **38**, 992—998).—Dibromotetra-amminecobalt bromide, prepared by the action of fuming hydrobromic acid on carbonatotetra-amminecobalt bromide according to the equation  $[\text{CO}_3 \cdot \text{Co}(\text{NH}_3)_4]\text{Br} + 2\text{HBr} = \text{H}_2\text{O} + \text{CO}_2 + [\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{Br}$ , is a green, amorphous solid.

*Dibromotetra-amminecobalt chloride*,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{Cl} \cdot \text{H}_2\text{O}$ , prepared by the action of concentrated hydrochloric acid on the bromide, forms glistening, green, prismatic needles, the aqueous solution of which quickly changes at the ordinary temperature into the corresponding aquo-salt, thus,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{Cl} + \text{H}_2\text{O} = [\text{Br}(\text{H}_2\text{O})\text{Co}(\text{NH}_3)_4]\text{ClBr}$ , the aqueous solution of which is reddish-violet. The *iodide*,  
 $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{I}$ ,

prepared by the action of potassium iodide on the preceding salt, forms greenish-brown needles; the formation of the corresponding aquo-salt proceeds slowly. The *platinichloride*,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]_2\text{PtCl}_6$ , and the *aurichloride*,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{Cl} \cdot \text{AuCl}_3$ , were prepared.

The *sulphate*,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]_2\text{SO}_4$ , prepared by the action of dilute sulphuric acid on the dibromochloride, forms light green crystals, which are readily acted on by water to form the aquo-salt. Whilst in the dichloro-series a hydrogen sulphate only has been isolated

having the formula  $[\text{Cl}_2\text{Co}(\text{NH}_3)_4]\text{SO}_4\text{H}$ , in the dibromo-series the normal salt is formed.

The *nitrate*,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{NO}_3$ , forms bright green prisms. The *dichromate*,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]_2\text{Cr}_2\text{O}_7$ , forms yellowish-green plates. The *thiocyanate*,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{CNS}$ , forms green crystals.

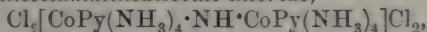
The dibromo-salts described form green solutions with water, which are rapidly changed, first into bromoaquatetra-amminecobalt salts, and then into diaquo-salts, thus,  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{Br} + \text{H}_2\text{O} =$

$[\text{BrCo}(\text{H}_2\text{O})(\text{NH}_3)_4]\text{Br}_2$   
and  $[\text{BrCo}(\text{H}_2\text{O})(\text{NH}_3)_4]\text{Br}_2 + \text{H}_2\text{O} = [\text{Co}(\text{H}_2\text{O})_2(\text{NH}_3)_4]\text{Br}_3$ .

These transformations may be studied by determinations of the variation of the electrical conductivity of the solutions. A. McK.

**Saturated Series of Dicobaltamine Compounds.** ALFRED WERNER and R. FEENSTRA (*Ber.*, 1905, 38, 923—925).—The cobalt-ammines richest in ammonia have the formula  $[\text{Co}(\text{NH}_3)_6]\text{X}_3$ . In addition to these simple compounds, other saturated derivatives containing more than one atom of cobalt and of the general type  $\text{X}_2[\text{Co}(\text{NH}_3)_5\cdot\text{NH}\cdot\text{Co}(\text{NH}_3)_5]\text{X}_2$  have been prepared.

*Iminodipyridineoctamminedicobalt chloride,*



is obtained by warming dichloroaquatriamminecobalt chloride with water and pyridine. The yield is small and appears to vary considerably; on treatment with concentrated hydrobromic acid, the corresponding *bromide* is obtained; this forms large, glistening, brownish-yellow needles containing  $2\text{H}_2\text{O}$ . J. J. S.

**Hexahydroxylaminecobalt Salts.** ALFRED WERNER and E. BERL (*Ber.*, 1905, 38, 893—899. Compare Feldt, *Abstr.*, 1894, ii, 187).—Hexahydroxylaminecobalt chloride,  $[\text{Co}(\text{NH}_2\cdot\text{OH})_6]\text{Cl}_3$ , formed by the action of hydroxylamine hydrochloride on dichlorodiethylenediaminecobalt chloride or on chlorohydroxylaminediethylenediaminecobalt chloride in aqueous potassium hydroxide solution, crystallises in large, golden leaflets, darkens on exposure to light, and yields cobalt chloride when boiled with acetic anhydride. With potassium ferrocyanide in aqueous solution, the chloride forms a reddish-brown, crystalline precipitate, which decomposes on exposure to light; with sodium acetate a yellow, crystalline precipitate, with potassium ferricyanide a brown, amorphous precipitate, and with sodium carbonate and with hydriodic acid yellow, unstable precipitates are formed. With hydrobromic acid in aqueous solution, hexahydroxylaminecobalt chloride forms the yellow, crystalline *bromide*; with ammonium oxalate the yellow, crystalline *oxalate*, with nitric acid the *nitrate* which crystallises in long, yellow needles, with sulphuric acid the yellow *sulphate*,  $[\text{Co}(\text{NH}_2\cdot\text{OH})_6]_2(\text{SO}_4)_3\cdot 2\text{H}_2\text{O}$ , which decomposes at  $90\text{--}100^\circ$ , and with potassium cyanide a yellow, unstable *cyanide* are formed.

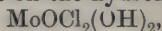
G. Y.

**Chlorinated and Brominated Molybdates, Brominated Molybdites, and their Corresponding Acids.** RUDOLF F. WEINLAND and W. KNÖLL (*Zeit. anorg. Chem.*, 1905, 44, 81—116. Compare

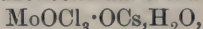


Abstr., 1904, ii, 263; this vol., ii, 326).—Since oxygen in molybdates can be replaced by sulphur, it can also be replaced by chlorine or by bromine.

Trichloromolybdic acid,  $\text{MoOCl}_3 \cdot \text{OH} \cdot 7\text{H}_2\text{O}$ , prepared by the action of fuming hydrochloric acid on the hydroxychloride,



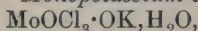
forms green prisms, from the solution of which in water molybdic acid does not separate. *Dicæsium tetrachloromolybdate*,  $\text{MoCl}_4(\text{OCs})_2$ , prepared from the hydroxychloride,  $\text{MoOCl}_2(\text{OH})_2$ , and cæsium chloride, forms green, hygroscopic crystals, from the aqueous solution of which molybdic acid separates. *Monocæsium trichloromolybdate*,



forms greenish-yellow, hygroscopic crystals. *Cæsium hydrogen chlorotrimolybdate*,  $\text{Mo}_6\text{O}_{11}\text{Cl}_{14} \cdot \text{Cs}_2\text{O} \cdot 22\text{H}_2\text{O}$ , forms hygroscopic prisms.

*Dirubidium tetrachloromolybdate*,  $\text{MoCl}_4(\text{ORb})_2$ , forms tetragonal plates. *Monorubidium trichloromolybdate*,  $\text{MoOCl}_3 \cdot \text{ORb} \cdot \text{H}_2\text{O}$ , forms hard crystals.

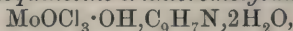
*Dipotassium tetrachloromolybdate*,  $\text{MoCl}_4(\text{OK})_2 \cdot 2\text{H}_2\text{O}$ , forms greenish-yellow, hexagonal plates. *Monopotassium trichloromolybdate*,



forms hexagonal plates. *Potassium hydrogen chlorotrimolybdate*,  $\text{Mo}_6\text{O}_{11}\text{Cl}_{14} \cdot \text{K}_2\text{O} \cdot 6\text{H}_2\text{O}$ , crystallises in prisms.

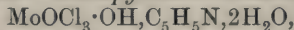
*Diammonium tetrachloromolybdate*,  $\text{MoCl}_4(\text{ONH}_4)_2 \cdot 2\text{H}_2\text{O}$ , forms hexagonal plates.

*Diquinoline tetrachloromolybdate*,  $\text{MoCl}_4(\text{OH})_2(\text{C}_9\text{H}_7\text{N})_2 \cdot 9\text{H}_2\text{O}$ , forms rhombic plates. *Monoquinoline trichloromolybdate*,



separates from strong hydrochloric acid in colourless needles.

*Dipyridine tetrachloromolybdate*,  $\text{MoCl}_4(\text{OH})_2(\text{C}_5\text{H}_5\text{N})_2 \cdot 2\text{H}_2\text{O}$ , crystallises in white leaflets. *Monopyridine trichloromolybdate*,



separates from hydrochloric acid in needles. *Hydrogen pyridine chlorotrimolybdate*,  $\text{Mo}_3\text{O}_5\text{Cl}_7 \cdot \text{OH} \cdot \text{C}_5\text{H}_5\text{N} \cdot 10\text{H}_2\text{O}$ , forms hygroscopic prisms, which on exposure gradually become blue. *Hydrogen pyridine chlorononmolybdate*,  $\text{Mo}_9\text{O}_{17}\text{Cl}_{18}(\text{OH})_2(\text{C}_5\text{H}_5\text{N})_2 \cdot 5\text{H}_2\text{O}$ , forms tetragonal or hexagonal prisms.

*Monoquinoline tribromomolybdate*,  $\text{MoOBr}_3 \cdot \text{OH} \cdot \text{C}_9\text{H}_7\text{N} \cdot 2\text{H}_2\text{O}$ , prepared from the mixture of bromides containing quinquevalent and sexavalent molybdenum (obtained from the action of anhydrous hydrogen bromide on heated molybdic acid) by treating it with bromine and then adding quinoline hydrobromide, forms yellowish-white leaflets.

*Dipyridine tetrabromomolybdate*,  $\text{MoBr}_4(\text{OH})_2(\text{C}_5\text{H}_5\text{N})_2 \cdot 2\text{H}_2\text{O}$ , forms yellow prisms.

*Dibromomolybdous acid*,  $\text{MoBr}_2\text{O} \cdot \text{OH} \cdot 1\frac{1}{2}\text{H}_2\text{O}$ , forms dark brown, hygroscopic prisms. *Tetrabromomolybdous acid*,  $\text{MoBr}_4 \cdot \text{OH} \cdot 2\text{H}_2\text{O}$ , forms hygroscopic needles.

*Dicæsium pentabromomolybdite*,  $\text{MoBr}_5\text{OCs}_2$ , forms glistening octahedra.

*Dirubidium pentabromomolybdite*,  $\text{MoBr}_5\text{ORb}_2$ , forms rhombic pyramids, which are sometimes dark red and sometimes yellowish-green.

*Dipotassium pentabromomolybdate*,  $\text{MoBr}_5\text{OK}_2$ , forms dark red pyramids. *Monopotassium tetrabromomolybdate*,  $\text{MoBr}_4\cdot\text{OK}, 2\text{H}_2\text{O}$ , forms olive-green pyramids.

*Diammonium pentabromomolybdate*,  $\text{MoBr}_5\text{O}(\text{NH}_4)_2$ , forms reddish-brown octahedra.

*Monolithium tetrabromomolybdate*,  $\text{MoBr}_4\text{OLi}, 4\text{H}_2\text{O}$ , forms dark red, hygroscopic needles.

*Magnesium pentabromomolybdate*,  $\text{MoBr}_5\text{OMg}, 7\text{H}_2\text{O}$ , forms olive-green octahedra or hexagonal pyramids,

*Calcium tetrabromomolybdate*,  $\text{Ca}(\text{MoBr}_4\text{O})_2, 7\text{H}_2\text{O}$ , forms tetragonal plates.

*Diquinoline pentabromomolybdate*,  $\text{MoBr}_5\text{OH}_2, (\text{C}_9\text{H}_7\text{N})_2, 2\text{H}_2\text{O}$ , forms olive-green needles. *Monoquinoline tetrabromomolybdate*,  
 $\text{MoBr}_4\cdot\text{OH}, \text{C}_9\text{H}_7\text{N}, 2\text{H}_2\text{O}$ ,

forms red needles.

*Dipyridine pentabromomolybdate*,  $\text{MoBr}_5\text{OH}_2, (\text{C}_5\text{H}_5\text{N})_2$ , forms green needles.

*Monopyridine tetrabromomolybdate*,  $\text{MoBr}_4\cdot\text{OH}, \text{C}_5\text{H}_5\text{N}$ , forms red needles.

When attempts were made to prepare a copper salt containing quinequivalent molybdenum, glistening, black needles of the compound  $\text{CuBr}_3\text{H}, 10\text{H}_2\text{O}$  were obtained. A. McK.

**Properties of Tungsten Trioxide as a Ceramic Colouring Matter.** ALBERT GRANGER (*Compt. rend.*, 1905, 140, 935—936).—The use of tungsten trioxide as a yellow colouring matter in enamels and glazes is limited by the fact that the colour is destroyed at high temperatures, the glaze becoming opaque. The author finds, however, that permanent yellow glazes can be obtained by fusing tungsten trioxide at  $800^\circ$  with lead silicate, with a mixture of zinc borate and silicate, or with bismuth oxide; whilst a glaze having the general formula  $\text{MO}, 1.4\text{SiO}_2, 0.1\text{Al}_2\text{O}_3, 0.5\text{B}_2\text{O}_3, 0.1\text{WO}_3$ , where M represents  $\text{Na}_2$ , Ca, or Pb, is readily fusible, transparent, and yellow in colour.

M. A. W.

**Sodium Hexatungstate.** A. W. LEONTOWITSCH (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 130—141).—The author has been unable to prepare the sodium octotungstate described by Ullik (*Sitzungsber. Wien. Akad.*, 56, [ii], 157), but has obtained a sodium hexatungstate,  $\text{Na}_2\text{W}_6\text{O}_{19}, 15\text{H}_2\text{O}$ , which forms long crystals and may be recrystallised without decomposition. T. H. P.

**Perstannic Acids and Perstannates.** SEBASTIAN TANATAR (*Ber.*, 1905, 38, 1184—1186).—Stannic acid, which had been precipitated from a solution of stannous chloride by sodium carbonate, was triturated with an excess of a 30 per cent. solution of hydrogen peroxide and the mixture heated at about  $70^\circ$ . After remaining for some days in a desiccator, a white, amorphous powder,  $\text{HSnO}_4, 2\text{H}_2\text{O}$ , was obtained. On further exposure in a desiccator, this acid slowly loses water and oxygen. It undergoes with water partial decomposition into stannic acid and hydrogen peroxide. When dried at  $100^\circ$ , it is

converted into the acid,  $\text{H}_2\text{Sn}_2\text{O}_7 \cdot 3\text{H}_2\text{O}$ . This is a more convenient method for preparing the latter than Spring's method is.

*Potassium perstannate*,  $\text{KSnO}_4 \cdot 2\text{H}_2\text{O}$ , prepared by the action of hydrogen peroxide on potassium stannate, is a white, amorphous powder, which, when heated, parts with oxygen and water. Its aqueous solution has an alkaline reaction; on the addition of sulphuric acid, it decolorises permanganate. When heated, it is converted into the salt,  $\text{K}_2\text{Sn}_2\text{O}_7 \cdot 3\text{H}_2\text{O}$ .

*Sodium perstannate*,  $\text{NaSnO}_4 \cdot 2\text{H}_2\text{O}$ , prepared in a similar manner, is sparingly soluble in water, by which it is readily decomposed; it is a white, amorphous powder. A. McK.

**Separation of Thorium from the Cerite Earths by means of Normal Sodium Sulphite.** HERMANN GROSSMANN (*Zeit. anorg. Chem.*, 1905, 44, 229—236).—Normal sodium sulphite effects a quantitative precipitation of the tervalent cerite earths as normal sulphites, whilst thorium and zirconium salts, in the presence of an excess of the precipitant, form basic sulphites which are gelatinous and readily soluble. In the solution of the thorium salt, the existence of complex alkali thorium sulphites is assumed; the salt,  $\text{Th}_2(\text{OH})_2(\text{SO}_3)_3 \cdot 2\text{Na}_2\text{SO}_3 \cdot 22\text{H}_2\text{O}$ , was isolated as a solid, practically insoluble in water and readily soluble in dilute hydrochloric acid. The salt,  $\text{Th}(\text{OH})_2\text{SO}_3 \cdot 2\text{K}_2\text{SO}_3 \cdot 10\text{H}_2\text{O}$ , is a white, amorphous powder.

Chavastelon's method of separation cannot be applied when the amount of thorium present is small.

Normal ammonium sulphite precipitates dilute solutions of thorium nitrate as basic sulphite, whilst zirconium nitrate with an excess of sulphite gives a clear solution, from which gelatinous ammonium zirconium sulphite separates after 12 hours.

The more strongly basic cerite earths do not tend to form alkali double sulphites. The solubility of the hydroxides in sulphurous acid decreases in the sequence cerium, didymium, lanthanum, thorium.

A. McK.

**Chlorinated Antimonates. Metachloroantimonic Acid.** RUDOLF F. WEINLAND and HANS SCHMID (*Zeit. anorg. Chem.*, 1905, 44, 37—64. Compare Weinland and Feige, *Abstr.*, 1903, ii, 218).—*Metachloroantimonic acid*,  $\text{HSbCl}_6 \cdot 4\frac{1}{2}\text{H}_2\text{O}$ , prepared by passing chlorine into a solution of antimony trioxide in concentrated hydrochloric acid until the solution becomes greenish-yellow and then passing hydrogen chloride into it, forms greenish-yellow, hygroscopic prisms. When its aqueous solution is kept, or when it is boiled, antimonic acid separates. Determinations of the lowering of the freezing point of aqueous solutions of metachloroantimonic acid indicated that two different ions were present. The authors were unable to obtain the compound,  $\text{SbCl}_5 \cdot 5\text{HCl} \cdot 10\text{H}_2\text{O}$ , described by Engel. The chlorine in metachloroantimonic acid is only partially precipitated by the addition of silver nitrate.

*Ammonio-silver metachloroantimonate*,  $\text{AgSbCl}_6 \cdot 2\text{NH}_3$ , forms golden-yellow, hexagonal plates, which gradually become white and finally violet. It is decomposed by water forming silver chloride and anti-



monic acid. *Ammonio-copper metachloroantimonate*,  $\text{Cu}(\text{SbCl}_6)_2 \cdot 5\text{NH}_3$ , forms blue, glistening prisms. The *cadmium salt*,  $\text{Cd}(\text{SbCl}_6)_2 \cdot 7\text{NH}_3$ , forms yellowish-white, dendritic crystals. The *zinc salt*,  $\text{Zn}(\text{SbCl}_6)_2 \cdot 4\text{NH}_3$ , forms white prisms. The *nickel salt*,  $\text{Ni}(\text{SbCl}_6)_2 \cdot 6\text{NH}_3$ , forms green, glistening prisms.

*Pyridine silver metachloroantimonate*,  $\text{AgSbCl}_6 \cdot 2\text{C}_5\text{H}_5\text{N}$ , forms golden-yellow crystals.

*Pyridine copper metachloroantimonate*,  $\text{CuSbCl}_6 \cdot 5\text{C}_5\text{H}_5\text{N}$ , forms prisms of an ultramarine-blue tint.

The *basic salt*,  $\text{HSbCl}_6 \cdot 2\text{NH}_3$ , formed by the addition of a large excess of ammonia to metachloroantimonic acid, crystallises in white, tetragonal pyramids.

The *pyridine salt*,  $\text{HSbCl}_6 \cdot 2\text{C}_5\text{H}_5\text{N}$ , forms microscopic needles. The *quinoline salt*,  $\text{HSbCl}_6 \cdot 2\text{C}_9\text{H}_7\text{N}$ , forms golden-yellow, silky, tetragonal plates.

*Pyridine metachloroantimonate*,  $\text{HSbCl}_6 \cdot \text{C}_5\text{H}_5\text{N}$ , forms colourless needles; it is stable and not hygroscopic. The *pyridine salt*,  $\text{H}_3\text{Sb}_2\text{Cl}_{13} \cdot 3\text{C}_5\text{H}_5\text{N}$ , forms colourless needles. *Quinolinemetachloroantimonate*,  $\text{HSbCl}_6 \cdot \text{C}_9\text{H}_7\text{N}$ , separates from alcohol in glistening, yellow needles. *Quinoline pyrochloroantimonate*,  $\text{H}_2\text{SbCl}_7 \cdot 2\text{C}_9\text{H}_7\text{N} \cdot \text{H}_2\text{O}$ , forms nacreous leaflets.  
A. McK.

**Alloys of Antimony and Bismuth.** K. HÜTTNER and GUSTAV TAMMANN (*Zeit. anorg. Chem.*, 1905, **44**, 131—144).—The curve of cooling of mixtures of antimony and bismuth has been studied by the authors. From molten masses rich in antimony, crystals rich in antimony first separate; the main amount of this molten mass solidifies about  $50^\circ$  below the temperature at which crystallisation begins. Molten masses which contain less than 70 per cent. of antimony do not crystallise until the melting point of bismuth is reached, and finally bismuth itself separates in almost a pure state. When alloys of antimony and bismuth are allowed to cool very slowly, the structure of the solid which separates is homogeneous; it is very probable that the two metals are miscible in all proportions. In molten masses containing antimony up to 60 per cent., the temperature at the beginning of the crystallisation remains constant for a time. The relationship between the temperatures at which crystallisation begins and the percentage of antimony is expressed by the tabulated results.  
A. McK.

**Inorganic Colloids.** ALEXANDER GUTBIER and GUSTAV HOFMEIER (*Zeit. anorg. Chem.*, 1905, **44**, 225—228).—An unstable colloidal form of bismuth was obtained by the action of hypophosphorous acid on bismuth oxychloride. When a dilute solution of hydrazine hydrate is added to a hot dilute solution of ammoniacal copper sulphate, a copper hydrosol is obtained from which copper gradually separates. In the presence of gum arabic, this hydrosol is more stable. Attempts to prepare mercury hydrosol were unsuccessful.  
A. McK.

**Hexahydroxyplatinic Acid.** ITALO BELLUCCI (*Zeit. anorg. Chem.*, 1905, **44**, 168—184).—A detailed account of work already published

(Abstr., 1904, ii, 180). In addition, the author has determined the electrical conductivity of the salt,  $\text{Pt}(\text{OH})_6\text{K}_2$ , which undergoes normal dissociation in dilute aqueous solutions and is regarded as a salt of a dibasic acid; it undergoes no hydrolysis at  $25^\circ$  and is analogous to potassium platinichloride. The transport numbers of its ions are calculated.

The crystalline form of the salt was measured.

A. McK.

## Mineralogical Chemistry.

**Souesite, a Native Iron-nickel Alloy from British Columbia.** G. CHRISTIAN HOFFMANN (*Amer. J. Sci.*, 1905, [iv], 19, 319—320).—A grey, metallic sand forming the heavy residue from the gold washings on the Fraser River, near Lillooet, in British Columbia, consists of an iron-nickel alloy (47 per cent. of the whole sand) and scales of platinum (43 per cent.), together with flattened grains of iridosmine and gold, and grains of magnetite, ilmenite, quartz, and garnet. The iron-nickel alloy is in the form of small (the largest  $1\frac{1}{2}$  mm. diameter), very irregularly-shaped, rounded grains of a faint yellowish-steel-grey colour, with sub-metallic lustre; it is strongly magnetic and is malleable. Analysis by F. G. Wait gave:

Ni.	Co.	Fe.	Cu.	Siliceous matter.	Total.	Sp. gr.
75.50	nil	22.02	1.20	1.16	99.88	8.215

This mineral, to which the name *souesite* is given, is thus very similar to the awaruite of New Zealand, the josephinite of Oregon, and to an iron-nickel alloy from Piedmont.

L. J. S.

**Synthesis of Naphtha and its Origin.** M. A. RAKUSIN (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 79—83).—Since dextrorotatory naphtha derivatives have been obtained from several sources in the Caucasian district, and since the naphthene acids from kerosene are also optically active, the author considers that naphtha cannot be of exclusively inorganic origin. Optically active naphtha must be regarded as derived from plants or animals or both of these together, whilst inactive naphtha may be either inorganic or organic in its origin.

T. H. P.

**Chrysoberyl from Canada.** NEVIL NORTON EVANS (*Amer. J. Sci.*, 1905, [iv], 19, 316—318).—Chrysoberyl, a mineral not previously recorded from Canada, has been found with tourmaline in a pegmatite-vein traversing gneiss in Maskinonge Co., Quebec. The crystal examined is twinned and has the form of a hexagonal prism; it measures  $1\frac{1}{2}$  inches across. Analysis gave:

GIO.	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	Total.	Sp. gr.
17.78	76.76	6.07	100.61	3.52

L. J. S.

**Absence of Helium from Carnotite.** E. P. ADAMS (*Amer. J. Sci.*, 1905, [iv], 19, 321—322).—The formation of helium from radium suggests that radioactive minerals should contain helium. The gases given off when pitchblende, monazite sand, and thorianite are heated exhibit the spectrum of helium, but the same result was not obtained with carnotite. Three hundred grams of carnotite, of activity 0·8 that of metallic uranium, were heated to redness in a vacuum for 3 hours; after absorbing carbon dioxide, 10 c.c. of gas remained, which, on removing nitrogen, was reduced to 0·1 c.c.; this small amount gave the characteristic red spectrum of argon. The absence of helium may be explained by the state of aggregation of the mineral, which forms a very fine powder disseminated through sandstone; this is extremely permeable to gases, whilst minerals known to contain helium are massive and impervious. L. J. S.

## Physiological Chemistry.

**Influence of Ozone on the Lungs.** CHRISTIAN BOHR and VILH. MAAR (*Chem. Centr.*, 1905, i, 945; from *Skand. Arch. Physiol.*, 16, 41—66).—Ozone causes injury to the lung tissue, increases the oxygen intake and lessens the carbon dioxide output. W. D. H.

**Output of Carbon Dioxide after the Administration of Various Sugars.** JOHAN F. JOHANSSON, J. BILLSTRÖM, and C. HEIJL (*Chem. Centr.*, 1905, i, 944; from *Skand. Arch. Physiol.*, 16, 263—272).—Sucrose and lævulose have the same action on carbon dioxide excretion. Dextrose produces a greater output. Excretion of the gas and of sugar (in the urine) are not parallel. Sucrose is in the blood stream mainly an indifferent substance without influence on metabolism. The rapidity of combustion and of conversion into glycogen is less for lævulose than for dextrose. W. D. H.

**Carbon Dioxide Production in Muscular Work.** GUNNAR KORAEN (*Chem. Centr.*, 1905, i, 945; from *Skand. Arch. Physiol.*, 16, 381—389).—During hunger and great muscular work, the carbon dioxide in the blood is lessened, as well as during rest. This is not influenced by an exclusively fat diet, but the administration of sugar raises the amount to the normal level. In the first-named circumstances, the glycogen of the body is reduced to a minimum, and the decomposition of the body fat is increased by muscular work; but if the body has the opportunity to renew its store of glycogen, this substance participates in the process. W. D. H.

**Physico-chemical Theory of Fertilisation.** MARTIN H. FISCHER and WOLFGANG OSTWALD (*Pflüger's Archiv*, 1905, 106, 229—266).—The paper contains an account of colloidal solutions, including the



observations of Hardy, Bütschli, Quincke and others, and also of the methods by means of which such solutions (hydrosols) may be coagulated or transformed into hydrogels. A summary of the different methods of fertilisation is also given, including natural fertilisation by means of egg and spermatozoon, natural parthenogenesis, and artificial parthenogenesis, together with the different means by which the latter may be accomplished.

Fertilisation from the physiological point of view is regarded merely as the impetus to development of eggs, and from the morphological point of view consists in granulation, a phenomenon which is characteristic of all types of fertilisation.

All the artificial processes which can produce granulation of the ovule (fertilisation), for example, osmosis, specific action of salts, alteration of temperature, and mechanical methods, are the factors which can transform a hydrosol into a hydrogel, and the two processes are thus regarded as being similar if the egg-plasma is considered as a mixture of colloidal solutions.

The chief difference, morphologically, between natural fertilisation and ordinary coagulation is in the regular orientation according to which the granulation proceeds in fertilisation. This is attributed to the fact that in ordinary hydrogel formation granulation proceeds from numerous points, whereas in natural fertilisation it proceeds from one point only. In artificial parthenogenesis, granulation usually starts from several distinct points, and from this results the irregular nucleic and cell division often met with in such cases. J. J. S.

**Ions and Cardiac Rhythm.** STANLEY R. BENEDICT (*Amer. J. Physiol.*, 1905, 13, 192—204).—The experiments here recorded were performed with strips of tortoise heart muscle in various saline mixtures, and the results obtained do not bear out the views of Howell and other observers. The principal main conclusion drawn is that it is the anion, not the cation, which stimulates. W. D. H.

**Alkalinity of Blood.** ANASTAZY LANDAU (*Chem. Centr.*, 1905, i, 619—620; from *Arch. exp. Path. Pharm.*, 52, 271—288).—Blood was removed from the rabbit's carotid, coagulation prevented by sodium oxalate, and the alkalinity determined by the Zuntz-Loewy titration method. In another specimen, the proteids were first removed and the alkalinity (mineral alkalinity) then determined. The latter values agree well with Abderhalden's ash analyses. The total alkalinity of the plasma varies between 134 and 166 mg. sodium hydroxide per 100 c.c. The average value of the mineral alkalinity is 120.5, and of the proteid-alkalinity 25. The alkalinity of the red corpuscles is 852 (284 mineral, 568 proteid alkalinity). Poisoning by hydrochloric acid affects the proteid alkalinity most. Phosphorus poisoning has the same effect, but there are in this case other poisonous effects in addition to acid intoxication. W. D. H.

**Blood-coagulation. VI.** LEO LOEB (*Beitr. chem. Physiol. Path.*, 1905, 6, 260—286. Compare *Abstr.*, 1904, ii, 496).—In the blood of the crab, two coagulations occur: the first, leading to the formation of "cell-

fibrin," is due to an agglutination of the corpuscles ; on filtering this off, the second coagulation of the plasma takes place. The second coagulation is much accelerated by the addition of muscle extract ; the power of muscle extract in this direction is weakened by heating it to  $42^{\circ}$ , and destroyed at  $45^{\circ}$ . Extract of cell fibrin acts similarly. The rate of coagulation of crab plasma is lessened by dilution with water, and still more so by dilution with sodium chloride solutions. There is also evidence of inhibitory substances in muscle extract. Calcium chloride has little or no influence on the formation of "cell fibrin," but it considerably hastens the coagulation of the plasma, produced by the addition of muscle and "cell fibrin" extracts. Potassium oxalate and to a less extent sodium fluoride hinder or prevent the coagulation of the plasma. Crab's fibrinogen was prepared by Halliburton's method, and the phenomena of coagulation observed in solutions of this are on the whole the same as in the intact plasma. In the majority of cases, a mixture of "cell fibrin" extract and muscle extract has a stronger coagulating action than either component. This opens up the question of "activating" substances, among which lecithin and serum must be reckoned. Leech extract has no inhibitory action on crab's blood.

In the blood of the king-crab (*Limulus*), it is not easy to distinguish the two coagulations, possibly because the second occurs so quickly.

The coagulation of the blood of vertebrates and invertebrates is very similar. In both, two substances are important, namely, the tissue *coagulins* and substances present in the blood itself. The coagulins are within certain limits specific. The substances in the blood itself are only specific in so far that those from vertebrate animals have no influence on invertebrate blood. It is probable that the materials extracted both from the cellular elements of the blood and from tissues like muscle act directly on the fibrinogen of the blood-plasma, but the conditions for their action are different, for instance, the acceleration by calcium salts is more marked with the coagulins than with the material from the blood-corpuscles. In certain circumstances, a combination of the two substances is more active than the sum of their individual activities ; that this is due to the influence of the coagulin in converting prothrombin into thrombin is only one of several possibilities.

W. D. H.

**Laking of Red Corpuscles. Estimation of the Volume of the Blood-corpuscles.** HANS KOEPPE (*Pflüger's Archiv*, 1905, 107, 183—186, 187—192).—All experiments hitherto have led to the conclusion that the red corpuscles become laked when their semi-permeable membrane is destroyed or injured. Laking is thus regarded as the criterion of the destruction of the corpuscle, and is therefore irreversible. But observations some years ago on blood mixed with solutions of ammonium salts and subjected to centrifugalisation showed that under certain conditions the layer of corpuscles beneath the colourless, supernatant fluid was laked, but on being poured out into a watch-glass and kept, the corpuscles were soon indistinguishable from normal ones, and had suffered no injury. The repetition of these experiments with a very perfect centrifuge, making 6000 turns per

minute, led to the discovery of the explanation. This centrifuge is so rapid in action that a separation of plasma and corpuscle can be accomplished before coagulation sets in, and mixture of the blood with foreign agents is unnecessary. After centrifugalising, the corpuscles are laked, but on standing subsequently their normal opaque appearance returns. The explanation is as follows: ordinary blood is opaque in the same way as an emulsion is, because of the different refraction of the corpuscles and the intervening fluid. The force of the centrifuge, however, is sufficient to press the corpuscles together, and they are placed wall to wall without any intervening fluid; the walls are composed of a fat-like material and are transparent, and so the whole mass of corpuscles is transparent. After the centrifugal force is stopped, and the blood is poured out into a watch glass, the usual condition of things is re-established. The invention of a centrifuge so perfect should render the determination of the volume of corpuscles by its means much more frequently employed than it is at present. The results have been regarded as doubtful in the past, different observers with different centrifuges obtaining inconstant figures. There need be no fear of an alteration in their volume, for, in order to press water through a semi-permeable uninjured membrane, a pressure of seven atmospheres is required, and such a pressure does not occur in the centrifuge.

W. D. H.

**Union of Carbon Dioxide with Amphoteric Amino-substances.** MAX SIEGFRIED (*Zeit. physiol. Chem.*, 1905, 44, 85—96).—Amino-acids like asparagine, peptone, and the body proteids unite organically with carbon dioxide. The occurrence of such compounds in the blood and in muscle is a factor in respiratory exchange, and Bohr's compound of carbon dioxide with hæmoglobin thus appears in a new light. The same is true in vegetable physiology in reference to the question of carbon dioxide reduction.

W. D. H.

**Behaviour of Sodium Fluoride towards Blood.** MASATO TOYONAGA (*Bull. Coll. Agric. Tōkyō*, 1905, 6, 361—363).—Sodium fluoride (0.3 per cent.), like normal oxalates, checks coagulation. When larger amounts are employed (4 per cent. at 25° and 1 per cent. at the ordinary temperature), the serum becomes viscous, or almost gelatinous, due probably to its combining with the proteid of the blood. This would account for the stiffening of the muscles of a dead rabbit observed by von Fürth after injection of a 3 per cent. solution of sodium fluoride (*Abstr.*, 1903, ii, 440). This can, at any rate, have nothing to do with the lime present in the tissues, since it is now shown that injection of a 10 per cent. solution of potassium oxalate left the muscles of a dead rabbit soft and flexible even after 15 minutes.

Arthus (*Jahresb. Tierchem.*, 1901—1902) found that 0.3 per cent. of sodium fluoride had no effect on blood and that 0.5 per cent. gave a precipitate.

N. H. J. M.

**Phosphorus Metabolism in Man.** CARL TIGERSTEDT (*Chem. Centr.*, 1905, i, 946; from *Skand. Arch. Physiol.*, 16, 67—68).—On an almost phosphorus-free diet, the experimenter passed 0.134



gram of phosphorus in the faeces. How the phosphorus metabolism behaves with increase in supply of phosphorus is not decided. "Animal phosphorus" is, on the whole, better used than "vegetable phosphorus."

W. D. H.

**Absorption and Excretion of Iron in the Alimentary Canal of Dogs and Cats.** HUBERT SATTLER (*Chem. Centr.*, 1905, i, 621—622; from *Arch. exp. Path. Pharm.*, 52, 326—332).—By microchemical methods, it is shown that dogs and cats differ from herbivora in regard to the absorption and excretion of iron. Iron could not be demonstrated in the duodenal epithelium, and little or none in the lymph paths. In the large intestine, the results are also often negative. It is possible that iron is absorbed in a form not recognisable by the methods used.

W. D. H.

**Behaviour of Various Polypeptides towards the Pancreas Ferment.** EMIL FISCHER and EMIL ABDERHALDEN (*Sitzungsber. K. Akad. Wiss. Berlin*, 1905, 290—300. Compare Abstr., 1903, i, 694, 800; 1904, i, 867, 890, 917; 1905, i, 121, 122).—The behaviour of a number of synthetical polypeptides towards the pancreas ferment at 36° has been investigated. The ferment solution was obtained by means of a Pawloff fistula, and rendered active by a 5 per cent. solution of intestinal fluid. The results are contained in the following table:

Hydrolysed.	Not hydrolysed.
Glycyl- <i>l</i> -tyrosine	Leucylproline
Leucyl- <i>l</i> -tyrosine	Glycylphenylalanine
Dialanylecystine	Glycylglycine
Dileucylcystine	Diglycylglycine
Alanyl-leucylglycine	Triglycylglycine
Tetraglycylglycine	
Ethyl triglycylglycine	

In the case of *r*-alanyl-leucylglycine, hydrolysis proceeds selectively, the products of change being *d*-alanine, optically active leucylglycine, and probably an optically active alanyl-leucylglycine.

E. F. A.

**Assimilation Limits of Sugars.** FRANZ BLUMENTHAL (*Beitr. chem. Physiol. Path.*, 1905, 3, 329—341).—In both men and animals the assimilation limit for sugar is low; the ability of the organism to destroy sugar or store it as glycogen is thus limited, and the sugar appears in the urine. The majority of the experiments here recorded were performed by injecting different quantities of different sugars into rabbits and examining the urine. The limit for galactose is especially low; that for dextrose and laevulose is about equal. The numerical results are given in tables.

W. D. H.

**Adenase.** WALTER JONES and M. C. WINTERNITZ (*Zeit. physiol. Chem.*, 1905, 44, 1—10).—In the autolysis of organs, attention is drawn to three ferments concerned in the changes which occur in

purine derivatives. These are guanase, which converts guanine into xanthine, adenase, which converts adenine into hypoxanthine, and oxydase, which oxydises hypoxanthine into xanthine. These are independent of each other and are all present in thymus and suprarenal glands. In the pancreas, oxydase is absent or nearly so. In the spleen, guanase is almost entirely absent, adenase is present in abundance, and oxydase in small quantity. In the liver, the same is true except that oxydase is more abundant. These results are arrived at by examining the products of autolysis in each case, with and without the addition of one or other of the purine bases. W. D. H.

#### Proteolysis and Proteid Synthesis in the Animal Organism.

EMIL ABDERHALDEN (*Zeit. physiol. Chem.*, 1905, 44, 17—52).—A discussion of the views of Kühne, Kutscher, and Fischer on the action of proteolytic ferments and on the question whether or not proteids are resynthesised in the body from simple cleavage products. Experiments on dogs are described in which the cleavage products were estimated in the contents of the alimentary canal and in which the urine was also examined. These are compared with the products of proteolysis obtained *in vitro* by Fischer's method. Some analyses of pathological urine are also given. The general conclusion drawn is that the breakdown of proteid into simple crystalline products is incomplete in the body. W. D. H.

**The Importance of the Digestion of Proteids for their Assimilation.** EMIL ABDERHALDEN (*Chem. Centr.*, 1905, i, 890—891; from *Centr. Stoffwechsel. u. Verdauungskrankh.*, 1904, 5, 649—651).—A paper on similar lines to the preceding one. W. D. H.

**Glycogen.** KARL GRUBE (*Pflüger's Archiv*, 1905, 107, 483—489, 490—496).—The glycogen in the liver is uniformly distributed; this is by no means an unimportant point when a small piece of liver only is analysed as a sample of the whole organ. This statement has been questioned in the past, but by Pflüger's method it is shown to be true. Any small variations are due to the relative admixture of connective tissue. By artificially perfusing the liver with defibrinated blood from the same animal (dog), to which various carbohydrates are added, it is shown that glycogen is formed from dextrose, dextrin, and lævulose, and the carbohydrate added to the blood becomes lessened. The liver should be kept *in situ*, and the artificial perfusion begun without any pause after the cessation of the natural circulation. The operative procedure by which this is done is described. W. D. H.

#### Twitchings of Skeletal Muscles produced by Salt Solutions.

WALTER E. GARREY (*Amer. J. Physiol.*, 1905, 13, 186—191).—An examination of various salts in the production of twitchings in the skeletal muscles of frogs and mammals. In the latter animals the contractions are feeble and not so rhythmic as in the frog.

W. D. H.

**Influence of Alcohol, Sugar, and Tea on the Contractility of Muscle.** A. F. HELLSTEN (*Chem. Centr.*, 1905, i, 945; from *Skand. Arch. Physiol.*, 16, 139—221).—The contractility of muscle is first increased by alcohol, and then diminished; it is increased by sugar and by tea. Practical considerations are pointed out. W. D. H.

**Chemistry of Invertebrate Muscle.** ARTHUR B. GRIFFITHS (*Chem. News*, 1905, 91, 146—147).—The muscles of various invertebrates were examined. They yielded myosin, musculin, myosinogen, myoglobulin, and myoalbumose. Analytical numbers obtained in each case are given for gases ( $\text{CO}_2$  liberated at  $60^\circ$ ,  $\text{CO}_2$  liberated by acid, nitrogen), water, solids, coagulated albumins, soluble albumins, fat, gelatin, creatine, ash, and individual ash constituents. D. A. L.

**Amount of Lime in Different Animal Organs.** MASATO TOYONAGA (*Bul. Coll. Agr. Tōkyō*, 1905, 6, 357—360. Compare Abstr., 1904, ii, 751; and Aloy, *Jahresb. Tierchem.*, 32, 700).—The amounts of dry matter, ash, calcium, and magnesium dissolved from different livers by water, 1 per cent. acetic acid, and alcohol, and the amounts in the undissolved residues were determined. The results relating to calcium and magnesium are as follows: horse liver, Ca 0.1479, Mg 0.1681; bullock's liver, Ca 0.1918, Mg 0.1977; pig's liver, Ca 0.1779, Mg 0.1853 per thousand of fresh substance.

Human liver contains, according to Oidtmann, Ca 0.2842 and Mg 0.0125; whilst dog's liver (Aloy, *loc. cit.*) contains Ca 0.175—0.259 and Mg 0.048—0.066 per thousand. N. H. J. M.

**Catalytic Decomposition of Hydrogen Peroxide.** ARTHUR S. LOEVENHART (*Amer. J. Physiol.*, 1905, 13, 171—185. Compare Abstr., 1903, ii, 415).—Recent work by Cohnheim and others on co-ferments suggested the study of the effects of mixing various extracts on some well understood chemical process. The catalysis of hydrogen peroxide was selected for this purpose. Using the un-neutralised commercial material, it was found that the extract both of pancreas and muscle enormously accelerates its decomposition by liver extract, and this power is not destroyed by boiling. But it was further found that both boiled and fresh liver extract have the same influence on liver extract, and that when neutralised hydrogen peroxide is employed, no such acceleration occurs in any case; the accelerating action is simply due to the neutralisation of the retarding effect of the acid in the commercial preparation. It would therefore have been simple from the first experiments to have concluded that the pancreas and muscle contain a catalo-kinase or co-ferment. The whole kinase conception rests on equally flimsy foundations. W. D. H.

**Uric Acid.** RICHARD BURIAN (*Chem. Centr.*, 1905, i, 686; from *Med. Klinik*, i, 131—134).—A statement of the author's views on the origin of uric acid in man. An article on its destruction and excretion is to follow. W. D. H.

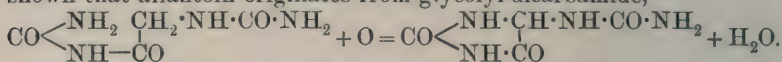


**Formation of Allantoin in the Animal Body.** HANS EPPINGER (*Beitr. chem. Physiol. Path.*, 1905, 6, 287—295).—*Hydantoamide*,  $C_3H_7O_2N_3$ , prepared by the action of aqueous ammonia on ethyl hydantoate, crystallises in rhombic prisms, melts at  $180^\circ$ , and is readily soluble in water, sparingly so in alcohol.

*Glycolyldicarbamide*,  $NH_2 \cdot CO \cdot NH \cdot CH_2 \cdot CO \cdot NH \cdot CO \cdot NH_2$ , obtained by the interaction of molecular quantities of potassium cyanate, hydantoamide, and sulphuric acid, forms long prisms, melts at  $158^\circ$ , and is readily soluble in water, sparingly so in alcohol or ether.

In order to exclude the possibility that the reaction had taken the alternative course and so led to the formation of the isomeric *biuret-acetamide*,  $NH_2 \cdot CO \cdot NH \cdot CO \cdot NH \cdot CH_2 \cdot CO \cdot NH_2$ , this substance was synthesised by first treating ethyl hydantoate with potassium cyanate and sulphuric acid, when *ethyl biuret-acetate*,  $C_6H_{11}O_4N_3$ , was obtained, crystallising in thin, prismatic needles melting at  $127^\circ$ , and on treatment with ammonia yielding *biuret-acetamide*, which forms quadratic tablets and melts at  $170^\circ$ .

By feeding experiments on dogs and by perfusion of the liver, it is shown that allantoin originates from glycolyl-dicarbamide,



The formation of a closed ring by a vital oxidation process is interesting and may throw light on uric acid formation in birds. Oxidation of glycolyl-dicarbamide with calcium permanganate leads to a similar result.

W. D. H.

**Lecithin in Heart and Kidneys in the Normal Condition, during Starvation, and in Fatty Degeneration.** V. RUBOW (*Chem. Centr.*, 1905, i, 620; from *Arch. exp. Path. Pharm.*, 52, 173—204).—The lecithin of heart muscle constitutes 60—70 per cent. of the fatty extract after removal of all visible fatty tissue. This is much higher than in skeletal muscle. In inanition this alters but little, and in fatty degeneration produced by phosphorus or protracted chloroform poisoning the amount of lecithin may increase or remain normal. Experiments on the kidneys are incomplete; in the healthy state, the two kidneys contain an equal amount of lecithin.

W. D. H.

**Anti-ferments.** BEITZKE and CARL NEUBERG (*Chem. Centr.*, 1905, i, 943—944; from *Verh. d. deutsch. Pathol. Ges.*, 1905, 160—161).—Anti-emulsin was first prepared by rectal immunisation by Hildebrandt's method; it can also be obtained from rabbits after subcutaneous injections of emulsin. It is contained in the globulin fraction of the serum. Added to dextrose or galactose, after 8 days at  $38^\circ$ , there is an increase in optical activity, which thenceforth for  $4\frac{1}{2}$  weeks remains unaltered. Lactosazone is then obtainable. Neither normal rabbit's serum nor that obtained after immunisation with emulsin leads in this way to disaccharide formation. The question as to whether other anti-substances have a synthetic function was investigated.

W. D. H.

**The Catalase of Milk.** EMIL REISS (*Chem. Centr.*, 1905, i, 684; from *Zeit. Klin. Med.*, 56, 1—12).—Cream decomposes hydrogen peroxide more vigorously than milk; this confirms Faitelowitz (*Diss. Heidelberg*, 1904). The catalase is associated with the fat globules in a physical way, and is insoluble in the presence of colloids.

W. D. H.

**Human Bile.** H. P. T. ÖRUM (*Chem. Centr.*, 1905, i, 942—943; from *Skand. Arch. Physiol.*, 16, 273—333).—In addition to glycocholic acid, human bile contains a variable amount of glycocholeic acid.

W. D. H.

**Perfusion Experiments on Excised Kidneys.** TORALD SOLL-MANN (*Amer. J. Physiol.*, 1905, 13, 241—303).—A full account of experiments previously published (this vol., ii, 181).

W. D. H.

**Effects of Ligature of One Ureter.** MISS B. SHELDON AMOS (*J. Path. Bact.*, 1905, 10, 265—286).—Ligature of one ureter in rabbits and guinea-pigs leads after some weeks or months to death. This may be preceded by Cheyne-Stokes breathing and wasting, but only occasionally by slight albuminuria, and never by œdema. There are obvious changes in the affected kidney, and very slight ones in the other and in the liver; the heart is normal. Death cannot be due to the inability of one kidney to perform the work of the two, or to the internal secretion of one kidney being insufficient to sustain life, since extirpation of one kidney is not fatal. The poison is probably not due to absorption of the products of disintegration of the kidney cells, for these when injected are not toxic. Death is probably the result of absorption of the products of the secretion of the ligatured kidney.

W. D. H.

**Precipitation of Lævulose from Urine by Lead Acetate.** RUDOLF ADLER and OSCAR ADLER (*Ber.*, 1905, 38, 1164—1165).—Contrary to Külz's statement (*Zeit. Biol.*, 1890, 27, 235), lævulose is precipitated, often in considerable amount, from urine by the addition of lead acetate.

W. A. D.

**Statistical Tables of the Amount of Nitrogenous Substances in Human Fæces.** FELIX OEFELE (*Chem. Centr.*, 1905, i, 776—777; from *Ber. deut. pharm. Ges.*, 15, 17—29. Compare *Abstr.*, 1904, ii, 102).—The average percentages in dry substances are as follows: nitrogen in substances soluble in water, 2; in the ammonia group, 0·5; in the indole group, 0·8; in the urobilin group, 0·7; in the purine group, 0·1; in mucin, 0·2; in micro-organisms, 1·7: total nitrogen, 5·5. The proteid in the micro-organisms consists to a large extent of mucin.

W. D. H.

**Composition of Blood and Exudations in Disease.** KASIMIR VON RZENTKOWSKI (*Chem. Centr.*, 1905, i, 942; from *Virchow's Archiv*, 179, 405—450).—Hydræmia occurs in various acute and chronic infectious and anæmic conditions, in kidney disease, and in pneumonia.

Transudations are believed at first to be mere aqueous solutions of salts; the proteid in them is a secondary addition. Some details of total and residual nitrogen are also given. W. D. H.

**Chemistry of Cancer. II. Abnormal Fermentative Occurrences.** CARL NEUBERG (*Chem. Centr.*, 1905, i, 760; from *Berlin. Klin. Woch.*, 1905, 118—119).—The action of radium emanations on carcinomatous tissue is to influence the ferment action in the cancer cells. By autolysis of liver-cancer, a characteristic product appears, namely, free pentose; this is not formed from normal liver. This was confirmed in a case where the liver metastases originated from cancer of the stomach; the latter yielded no pentose. The high percentage of pentose in cancerous tissues is due to richness in nuclei. Normal liver juice does not influence the rate of autolysis in the lungs, but leads to the formation of albumoses (Jacoby, *Beitr. Chem. Physiol. Path.*, 3, 446); the juice of liver cancer leads to the opposite result, namely, an increase in simple cleavage products. W. D. H.

**Blood Changes in Plague.** LEONARD ROGERS (*J. Path. Bact.*, 1905, 10, 291—295).—In plague, the hæmoglobin and red corpuscles are not usually affected. Slight leucocytosis occurs during the first three days of the disease and usually disappears later. The leucocytosis mainly affects the lymphocytes. W. D. H.

**Leucocytosis of Typhus Fever.** ANDREW LOVE (*J. Path. Bact.*, 1905, 10, 296—327).—In typhus fever there is no evidence of destruction of red corpuscles; they may even be increased. This is evidence against Gotschlich's parasite being the cause of the disease. The leucocytosis resembles that in diplococcal infections. W. D. H.

**Poisons applied to the Outer Surface of the Mammalian Heart.** ALEXANDER BALDONI (*Chem. Centr.*, 1905, i, 621; from *Arch. exp. Path. Pharm.*, 52, 205—219).—The observations of Jacoby and Wybauw on the result of the application of helleborein to the outer surface of the frog's heart are here extended to mammals. Allylthiocarbimide and camphor have no important effect; physiological saline solution is wholly indifferent. A 0.9 per cent. solution of potassium chloride depresses the blood pressure, and stronger solutions stop the heart. Concentrated sodium chloride solution depresses blood-pressure also. Helleborein, digitalin, and bufotalin have the same effect and finally bring about diastatic stoppage of the heart. W. D. H.

**The Urine in Phosphorus Poisoning.** JULIUS WOHLGEMUTH (*Zeit. physiol. Chem.*, 1905, 44, 74—84).—In the urine in cases of phosphorus poisoning (rabbit and man), tyrosine, leucine, glycine, phenylalanine, alanine, and arginine are present. This is the first time a diamino-acid has been found in urine, but in a case of acute yellow atrophy of the liver Neuberg and Richter (*Deut. med. Woch.*, 1904, 30, 499) found lysine in the blood. W. D. H.



**Antidote to Nicotine.** C. ZALACKAS (*Compt. rend.*, 1905, 140, 741—742).—Experiments conducted on guinea-pigs and rabbits show that strychnine is not an effective antidote to nicotine poisoning; eserine is more effective, but the best antidote to nicotine is the alkaloid of *Nasturtium officinale*, two injections of the expressed juice of the plant completely counteracting the effect of a fatal dose of nicotine (0.025 gram) in the case of a rabbit, and similar results were obtained with dogs. M. A. W.

**Influence of Radium Emanations on the Toxicity of Venoms.** C. PHISALIX (*Compt. rend.*, 1905, 140, 600—602).—Exposure of the venom of the cobra and viper to radium emanations for 50 to 60 hours causes it to lose its toxic characters. The solution at the same time becomes opalescent owing to an agglutination of fine particles. The poison of the salamander or common toad is not affected. W. D. H.

**Hirudin.** ANDREAS BODONG (*Chem. Centr.*, 1905, i, 620—621; from *Arch. exp. Path. Pharm.*, 52, 242—261).—The substance named hirudin separated from leech extract has a very variable activity; the amount obtained diminishes on starvation; it is largest in amount in the autumn. The horse-leech forms none. Its power to inhibit fibrin formation is quantitative; excess remains free and active in the serum and passes into the urine in small amount. It produces no interference with circulation, respiration, or other bodily functions. W. D. H.

**Action of Cresol in comparison with Phenol.** KARL TOLLENS (*Chem. Centr.*, 1905, i, 622—623; from *Arch. exp. Path. Pharm.*, 52, 220—241).—The poisonous effects of phenol and of *o*-, *m*-, and *p*-cresols and their sodium compounds were investigated in frogs, mice, and cats. The differences noted are those of degree, *p*-cresol being decidedly more poisonous, *o*-cresol about equally poisonous, and *m*-cresol less poisonous, than phenol; the fatal doses exhibit a difference, but nothing very marked. The numbers obtained are given. W. D. H.

**Action of Morphine and its Derivatives.** ALEXANDER BABEL (*Chem. Centr.*, 1905, i, 623; from *Arch. exp. Path. Pharm.*, 52, 262—270).—Dionine, codeine, and heroine in comparison with morphine show pharmacodynamic differences. Mixed with brain substance, heroine is the one of which most is absorbed; heroine also is most soluble in fatty materials. Morphine is the least and dionine the most rapidly absorbed from the alimentary canal. W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

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**Influence of Metals on Fermenting Liquids.** LEOPOLD NATHAN, ARTHUR SCHMID, and WILLY FUCHS (*Centr. Bakt. Par.*, 1905, ii, 14, 289—296. Compare Abstr., 1904, ii, 505).—Fruit musts, notwithstanding their greater acidity and consequently greater power of dissolving metals, are less injured than beer worts. Only gold, silver, and glass are quite indifferent. Copper and nickel are slightly injurious; iron, zinc, lead, brass, tin, and aluminium are very injurious. N. H. J. M.

**Origin of Fusel Oil.** OSKAR EMMERLING (*Ber.*, 1905, 38, 953—956. Compare Abstr., 1904, ii, 834).—The fermentation of molasses by means of the organisms present on potato skins gives a mixture of ethyl, propyl, and *n*-butyl alcohols with lactic acid; amyl alcohol is not formed in this case. The principal organism causing the fermentation was isolated, but its nature is not yet definitely decided; contrary to the previous statement (*loc. cit.*), it is not strictly anaërobic. In presence of calcium carbonate, it ferments maltose, dextrose, and glycerol. With cane sugar, it gives rise to the foregoing alcohols, but the principal product is butyric acid with some acetic acid; carbon dioxide and hydrogen are evolved. W. A. D.

**Can Nitrite provide Oxygen in Anaërobic Culture of Bacteria?** T. TAKAHASHI (*Bul. Coll. Agr. Tōkyō*, 1905, 6, 403).—The oxygen of nitrites cannot replace atmospheric oxygen in the case of *Bacillus pyocyaneus*, *B. subtilis*, *B. mesentericus vulg.* and *fuscus*, *B. acidi lacti*, *Proteus mirabilis*, and the typhoid bacillus of mice. N. H. J. M.

**Chemical Changes attending the Aërobic Bacterial Fermentation of Simple Organic Substances. I. Carbamide, Asparagine, Albumose, and Rochelle Salt.** WALTER E. ADENEY (*Proc. Roy. Irish Acad.*, 1905, 25, 6—24).—The author has studied the fermentation of carbamide, asparagine, albumose, and Rochelle salt by means of organisms which are not specified and which were present in the distilled water used or in other substances employed in making up the solutions. The fermentation in each case was conducted under aërobic conditions and the products were estimated at intervals.

The organisms capable of initiating and effecting the hydrolysis of carbamide appear to exert that change entirely by enzyme action. When the conditions of fermentation are such that carbamide is subject to the physiological process of respiration, that is, when carbamide is the sole nutrient organic substance present, it undergoes only partial hydrolysis, the greater portion of it being oxidised to carbon dioxide, nitrogen trioxide, and ammonia.

Asparagine, when fermented by water organisms under aërobic conditions, may undergo complete enzyme change into aspartic acid and ammonia during the earlier stages of the bacterial growth, and the aspartic acid subsequently undergoes respiratory changes. In the

case of albumose, the oxygen absorbed and the carbonic dioxide and ammonia formed were the result of respiratory changes. Rochelle salt is quickly fermented when mixed with carbamide. In the absence of any other source of nitrogen except atmospheric air, it ferments to a less extent; it is converted first into potassium sodium malate, carbon dioxide, and water, and then the malate is oxidised to carbon dioxide and water.

A. McK.

**Action of Bacteria on Sugars.** ADALBERT SEGIN (*Centr. Bakt. Par.*, 1904, ii, 12, 397—400).— $\alpha$ -Glucose and quercitol were not attacked by any of the eight bacteria employed; both xylose and arabinose were decomposed by *Bacillus coli* and *B. enteris*.

The results accord with previous observations that aldehydic and ketonic sugars are much more readily attacked by bacteria than the corresponding alcohols.

N. H. J. M.

**Bacteriological Examination of Tidal Mud.** WILLIAM G. SAVAGE (*J. Hygiene*, 1905, 5, 146—174).—Mud samples yield more trustworthy bacteriological evidence of the degree of contamination of a tidal river than either water or oyster samples. The two latter only indicate immediate contamination; mud samples show evidence of part contamination for at least several weeks. Muds with high relative purity are safe for oysters. No evidence was obtained that either *Bacillus typhosus* or *B. coli* alter their characters in tidal mud. Typhoid bacilli readily survive for two weeks in tidal mud, and after that time their numbers as a rule rapidly decline.

W. D. H.

**Relationship of the Pseudo-diphtheria and the Diphtheria Bacillus.** G. F. PETRIE (*J. Hygiene*, 1905, 5, 134—145).—No substance capable of neutralising diphtheria antitoxin is present in filtrates of pseudo-diphtheria bacilli. Immunisation of horses with these filtrates does not produce an antitoxin to diphtheria toxin. The two bacilli, therefore, do not stand in any close relationship to each other.

W. D. H.

**Modification of the Method for Isolating Nitrifying Micro-organisms.** R. PEROTTI (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 228—231).—This method is a modification of that given by Omeliansky (*Abstr.*, 1900, ii, 232) and makes use of blocks of ordinary commercial magnesium carbonate, which may be fashioned either as flat plates to fit into Petri dishes or as parallelopipeds for employment in test-tubes. In the former case, the plate used is about 1 cm. in thickness, and the upper surface is rendered smooth by rubbing with a piece of unpolished glass and then with the fleshy part of the finger, whilst the under surface is hollowed out so as to allow more of the nutrient solution to be used. The latter consists of 50 c.c. of a solution containing 2 grams of ammonium sulphate, 1 gram of potassium phosphate, and 0.5 gram of magnesium sulphate per litre of water, this being mixed just before using with a drop of a 2 per cent. solution of ferrous sulphate and a drop of a saturated solution of sodium chloride. The parallelopipeds are smoothed as above.



After the sterilisation of the magnesium carbonate and nutrient solution in the test-tube or Petri dish, the liquid containing the micro-organisms is poured over the surface of the block and the whole kept at 28—30° in a thermostat. After a time, the surface of the block exhibits small, regular excavations in which the magnesium carbonate has assumed a dirty-yellow coloration. Microscopic examination reveals the presence of numerous bacteria resembling Winogradsky's *Nitrosomonas europæa*.  
T. H. P.

**Influence of Different Carbohydrates and Organic Acids on the Decomposition of Nitrates by Bacteria.** JULIUS STOKLASA and EUGEN VÍTEK (*Centr. Bakt. Par.*, 1905, ii, 14, 102—118 and 183—205).—The reduction of nitrates is due to the hydrogen, produced along with carbon dioxide, as the last products in the breaking down of carbohydrates and organic acids, and is similar to the reduction of arsenates, chlorates, and ferricyanides. Dextrose, lævulose, galactose, xylose, arabinose, and lactic, valeric, and succinic acids are all suitable as sources of carbon for the various bacteria which produce organic nitrogen from nitrates.

Xylan and araban and the corresponding pentoses are not very suitable for denitrification bacteria which liberate nitrogen, but seem to be available for the slow conversion of nitric and nitrous acids into ammonia. *Bacillus Hartlebi*, when cultivated in presence of arabinose, assimilated 33.62 per cent. of the total nitric nitrogen, converting it into proteids.

The widely distributed (in Bohemia) soil organism, *Clostridium gelatinosum*, together with *Bacillus mycoides*, *B. subtilis*, *B. mesentericus vulgaris*, &c., are of importance in the conversion of nitrates into ammonia (compare Laxa and Velich, *Ber. Versuchs-Stat. Rüben-zuckerind., k. k. böhm. techn. Hochschule in Prag*, 1902, 7). *Clostridium*, in arabinose, converted nearly 46 per cent. of nitric nitrogen into ammonia, whilst nearly 6 per cent. was utilised for proteid production.  
N. H. J. M.

**Fermentation-coefficient of Dead Yeast (Zymin) on Various Substrata.** L. TELESNIN (*Centr. Bakt. Par.*, 1904, ii, 12, 205—216).—The coefficient,  $\text{CO}_2/\text{O}_2$ , of zymin on sterilised water is higher than 1. Similar results were obtained with glycerol, mannitol, lactose, and ethyl alcohol. Quinine hydrochloride produced a decrease in the carbon dioxide and consequently a lower coefficient. Dextrose, fructose, maltose, and sucrose gave uniformly high coefficients which decreased after 48 hours; raffinose gave lower coefficients.

The disappearance of oxygen indicates the presence of an oxidising ferment (compare following abstract).  
N. H. J. M.

**Respiration and Fermentation of the Different Varieties of Dead Yeast.** J. WARSCHAWSKY (*Centr. Bakt. Par.*, 1904, ii, 12, 400—407).—Zymase is produced in varieties of yeast which induce alcoholic fermentation (*Saccharomyces cerevisiæ* l Hansen, *S. Pombe*) and are cultivated on substrata capable of fermenting, but not when they are cultivated on non-fermenting substrata. In the case of *S. Pombe*,

however, no zymase was produced when ammonium phosphate was present.

*S. Membranefaciens*, which has no power of fermentation, does not contain zymase. The coefficients, which varied between 0.35 and 0.49, indicate the presence of an oxydase.

N. H. J. M.

**Is Germination Possible in Absence of Air?** T. TAKAHASHI (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 439—442. Compare Abstr., 1903, ii, 170).—Former experiments with peas showed that germination did not take place in absence of air (compare Godlewski, Abstr., 1901, ii, 618, and 1904, ii, 507).

It is now shown that rice, which is accustomed to grow in swampy soils, will germinate in water alone, without addition of sugar and in absence of air. Alcohol was produced and there was a loss of 0.4354 gram of starch (in 2.3966 grams of seeds), which was consumed by intramolecular respiration after conversion into dextrose.

The normal respiration process is ascribed to the living protoplasm rather than to zymase (Godlewski), the amounts of which are generally very small (compare Mazé, Abstr., 1904, ii, 634, and Maximoff, *Ber. deut. bot. Ges.*, 1904, 22).

N. H. J. M.

**Processes of Assimilation. I.** HANS EULER (*Chem. Centr.*, 1905, i, 941; from *Arkiv Kem. Min. Geol.*, 1, 329—345. Compare Abstr., 1904, ii, 761).—The pressed juice of *Boletus scaber* decomposes hydrogen peroxide with great vigour owing to the presence of an enzyme *Boletus catalase*. The action remains practically constant for several days and is increased by the addition of weak solutions of bases, but is inhibited by small quantities of weak acids. The enzyme thus resembles O. Löw's  $\beta$ -catalase and Senter's hæmase except that its action is more affected by the presence of acids. The decomposition of hydrogen peroxide by this catalase takes place within certain limits in strict conformity with the equation for reactions of the first order. According to an approximate calculation, the decomposing action of *Boletus catalase* on hydrogen peroxide is much greater than that of colloidal platinum.

E. W. W.

**Processes of Assimilation. II. Condensation Products of Formaldehyde.** HANS EULER and ASTRID EULER (*Chem. Centr.*, 1905, i, 941; from *Arkiv Kem. Min. Geol.*, 1, 347—355. Compare Abstr., 1904, ii, 761).—The compound,  $\text{CH}_2\text{:N}\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}\cdot\text{H}_2\text{O}$ , prepared by shaking a solution of *p*-aminobenzoic acid with a 40 per cent. solution of formaldehyde, loses  $\frac{1}{2}\text{H}_2\text{O}$  at  $85^\circ$  and decomposes at  $207^\circ$  with evolution of gas; it is soluble in cold alkalis or acids, but insoluble in water. *Trimethyleneasparagine*,  $\text{C}_7\text{H}_{10}\text{O}_4\text{N}_2$ , obtained by saturating a 40 per cent. solution of formaldehyde with asparagine, swells up and decomposes at  $203^\circ$ ; when dried at  $85^\circ$ , it becomes yellowish-brown. The actual molecular weight of this compound appears to be at least six times as great as that corresponding with the simplest formula. The stability of methyleneasparagine and other methylene-amines has been examined by the freezing point method. It was found that in 0.5 to 0.1 normal solutions no action takes place between formaldehyde

and glycollic acid, carbamide or asparagine, the corresponding methylene-amines being resolved into their components. Similar results have been obtained in the case of alanine and tyrosine. It may be assumed, therefore, that the formaldehyde formed by the assimilation of carbon dioxide by the green plant does not combine with amino-derivatives of this kind.

E. W. W.

**Can Aluminium Salts enhance Plant Growth?** Y. YAMANO (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 429—432).—Pot experiments with barley and flax in which ammonium alum (0.2, 1 and 2 grams per kilo. of soil) was compared with ammonium sulphate, to which monosodium sulphate was added to make the amounts of sulphuric acid correspond, showed that moderate amounts of aluminium have a stimulating effect on plant development. In water cultures, 0.2 per cent. of alum acted injuriously after 3 weeks, and 0.8 per cent. killed the plants in a few days.

G. Smith (*Chem. News*, 1903, 88, 135) found 36—43 per cent. and even 79.66 per cent. of alumina in the ash of the peripheral parts of *Orites excelsa*; and Radlkofer (*Ber. deut. bot. Ges.*, 1904, 22, 216) found in various kinds of *Symplocos* a colourless substance consisting chiefly of aluminum salts. These plants were named *Arbor aluminosus* by Rumphius in 1690.

N. H. J. M.

**Production and Utilisation of Glycogen by Lower Vegetable Organisms.** BERTHOLD HEINZE (*Centr. Bakt. Par.*, 1904, ii, 177—191, 355—371; 1905, ii, 9—21, 75—87, and 168—183. Compare Abstr., 1904, ii, 504).—Cultivations of *Aspergillus niger* utilised glycogen with production of sugar and acids, probably acetic and formic acids, but not oxalic acid. Similar results were obtained with other organisms. In the case of *Mucor*, however, no sugar could be detected among the products; probably it is at once converted into alcohol and acids.

Attention is called to the importance of glycogen in connection with yeast fermentation and in the processes of assimilation of free nitrogen by azotobacter and by leguminous bacteria.

In experiments with nitrogen-assimilating organisms, it was found that satisfactory results could only be obtained with certainty when considerable amounts of soil were employed (1—10 grams per 100 c.c.). Pectin substances may be used with advantage in cultivations of azotobacter, and potassium phosphate is very beneficial.

N. H. J. M.

**Flowering of Bamboo.** OSCAR LOEW (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 365—369).—A barley plant grown in water-cultures was transferred when 29 cm. high to a fresh solution containing much more calcium nitrate and very much less magnesium sulphate. The change in the composition of the solution resulted in a very marked increase in the size of the leaves, but did not accelerate leaf formation. The plant died early owing, perhaps, to the precipitation of the soluble phosphates of the protoplasm as calcium phosphate.

Prolonged experiments with bamboo itself will be necessary to



ascertain the best means of checking the formation of buds. The results of observations made with annual grasses indicate that large applications of gypsum and sodium nitrate in conjunction with irrigation may be of use.

It is suggested that an application of dipotassium phosphate might prolong the lives of the leaves of the flowering *Gramineæ*, since it is probably this salt which is chiefly withdrawn from the leaves for seed production. Wolff and Ritthausen state that one rôle of silica is to hasten the death of the leaves in favour of the seed (compare also Kreuzhage and Wolff, *Abstr.*, 1884, 1211). N. H. J. M.

**Source and Composition of the Essential Oil of Herb Bennett Root: A New Glucoside and Enzyme.** ÉMILE BOURQUELOT and HENRI HÉRISSEY (*Compt. rend.*, 1905, 140, 870—872).—The dried root of Herb Bennett (*Geum urbanum*) has a feeble odour resembling that of cloves. If the plant be carefully plucked so as to leave the root intact, there is no manifestation of the characteristic odour, but this is at once detectable when the root is crushed between the fingers. The explanation of this phenomenon was established by the following experiments.

By extraction of the fresh root with boiling alcohol of 95°, distillation of the extract under reduced pressure, extraction of the residue with alcohol, and precipitation of the solution by excess of ether, a substance is obtained which is odourless, but, however, contains the substance which gives rise to the odoriferous principle. This proves to be eugenol.

Another portion of the root was macerated with sand and extracted with cold alcohol of 90°. The residual powder, which contains an enzyme, was dried at 30°. On adding to an aqueous solution of the first substance a little of the ferment powder, a distinct odour of cloves is at once evident. If the ferment powder is previously heated in boiling water, the effect is not observable. It is concluded from these observations that the odoriferous principle does not exist free in the Herb Bennett root, but is produced from some other substance present by the action of an enzyme. The substance is a glucoside; on addition of the enzyme to its aqueous solution, the reducing power and the rotary power both gradually increase.

The active enzyme is characteristic; the resolution of the glucoside is not effected by emulsin, invertase, nor by the enzyme of *Aspergillus niger*. It cannot be extracted by treatment of the roots with water.

The glucoside can be isolated in globular crystals by addition of ether to the alcoholic solution. The term *gëin* is proposed for the glucoside, and *gëase* for the enzyme. H. M. D.

**Fertilising Principles required by the Tobacco Plant.** CHARLES GIRARD and E. ROUSSEAU (*Compt. rend.*, 1905, 140, 733—735).—The authors have determined the impoverishment effected in the soil by the growth of the tobacco plant by estimating the quantity of nitrogen, phosphoric acid, potassium and calcium in the leaves, stems, roots, cuttings, and prunings of the plant. The results are tabulated in the original, and show that the efficiency of the

tobacco plant regarded as a vegetable machine is very low, only about one-half of the energy of the plant being expended in the production of the marketable product, namely, the leaves; on the other hand, the waste products form valuable manures.

M. A. W.

**Further Observations on Oxydases.** KEIJIRŌ ASŌ (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 371—374).—Guaiacol is less sensitive towards peroxides than potassium iodide-starch, and its reaction with nitrites much weaker than the iodine reaction. The loss of the power of liberating iodine which certain plant juices undergo when heated is attributed to the acidity of the juice and the presence of traces of amino-compounds, which together bring about the destruction of nitrites.

The substance which gives the guaiacol reaction is not the same as the one which liberates iodine (compare Bach and Chodalt, *Abstr.*, 1904, i, 359).

N. H. J. M.

**Ammoniacal Nitrogen as Plant Food.** MAX GERLACH and IGNAZ VOGEL (*Centr. Bakt. Par.*, 1905, ii, 14, 124—128. Compare Mazé, *Abstr.*, 1900, ii, 499).—Experiments in which maize was grown in sterilised soil (5.5 kilos.) without nitrogenous manure and with nitrogen (0.5 gram) in the form of ammonia and nitrate respectively showed that practically the whole of the ammoniacal nitrogen was assimilated, the production of dry matter being considerably increased.

Both manures, especially ammonium sulphate, retarded the growth at the commencement. The final increase in dry matter above ground was 31 per cent. with ammonium sulphate and 46 per cent. with nitrate (compare Takabayashi, *Abstr.*, 1897, ii, 585).

N. H. J. M.

**Comparison of the Organic Matter in Different Soil Types.** FRANK K. CAMERON (*J. Amer. Chem. Soc.*, 1905, 17, 256—258. Compare *Abstr.*, 1904, ii, 286).—Analyses of a large number of soils and subsoils shows that the average amounts of organic matter are respectively 2.06 and 0.83 per cent. In individual cases, the subsoil contains more organic matter than the surface soil. As a rule the colour of a soil varies with the amount of organic matter present, provided that the soils examined belong to the same type; but soils of different types cannot be compared in this manner owing to differences in colour due to mineral constituents and to differences in the character of the organic matter itself. The variations in the amounts of organic matter in the soils of one type are as great as between soils of different types.

N. H. J. M.

**Influence of Sodium Salts in the Soil on the Composition of Sugar Cane.** H. C. PRINSEN-GEERLIGS (*Chem. Centr.*, 1905, i, 897; from *Med. Proefstat. Suikerriet West Java*, No. 76).—Most of the chlorine in sugar cane is in combination with potassium, very little sodium being present. Sodium salts cannot take the place of potassium salts in sugar cane, and plants manured with sodium chloride soon fail if there is a deficiency of potassium in the soil.

N. H. J. M.

**Different Degrees of Availability of Plant Nutrients.** OSCAR LOEW and KEIJIRŌ ASŌ (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 336—346).—The ratios  $\text{CaO/MgO}$  which were found to be 1, 2 or 3, and 4 for cereals, for more leafy crops, and for tobacco respectively, are only correct when the two substances are present in the soil in equally available forms, as, for instance, when they are both present as carbonates. When calcium is present as carbonate and magnesium as sulphate, the ratio is 30:1 for rice in sand-cultures, and 7:1 in a soil containing much calcium zeolites and a little magnesium sulphate.

Experiments with barley manured with calcium carbonate (5 per cent.) and with gypsum (5 and 20 per cent.) in addition to double superphosphate, potassium sulphate, and ammonium nitrate showed that calcium carbonate increased the percentage of calcium in the plant ash much more than the larger amount of calcium sulphate. This is attributed to the low degree of availability of gypsum, the solubility of which is not increased by dilute acids.

Lower yields after liming certain soils are not always due to diminished solubility of phosphoric acid, but may sometimes be the result of an unfavourable lime-magnesia ratio. N. H. J. M.

**Injurious Effect of an Excess of Lime applied to the Soil.** S. SUZUKI (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 347—351).—Pot experiments with rice grown in soil showed that an excess of calcium carbonate greatly reduced the yield, even when the phosphoric acid was applied in the form of disodium phosphate. An equivalent amount of calcium sulphate greatly increased not only the total yield, but especially the amount of grain. Liming did not, therefore, diminish the availability of the phosphoric acid, but its assimilability in the cells themselves. The difference in the action of the two calcium salts is due to the low solubility of calcium sulphate and the greater solubility of the carbonate due to root acidity. Moderate amounts of calcium carbonate had no injurious effect, owing to the presence of 11 per cent. of humus in the soil.

Powdered magnesite added in such quantity that the ratio  $\text{CaO/MgO}$  was 1:3 greatly reduced the yield.

When bone-dust and disodium phosphate were applied alone, the production of seed was practically the same. N. H. J. M.

**Is the Availability of Phosphoric Acid in Bone-dust Modified by the presence of Gypsum?** TOMIO KATAYAMA (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 353—356).—Sand culture experiments are described in which rice received, in addition to bone-dust, nitrogen and potash, calcium and magnesium carbonates in different proportions, and calcium sulphate with different amounts of magnesium carbonate. The gypsum plants grew much better than those which received carbonate, and had a much better colour. An excess of magnesia was unfavourable.

Results of experiments in which the phosphoric acid was applied as dicalcium phosphate also showed that an excess of lime over magnesia has no injurious effect when present as gypsum.



The depression in the availability of bone-dust by moderate amounts of calcium carbonates is not opposed to Suzuki's results (preceding abstract), being due to the absence of humus. N. H. J. M.

**Influence of Various Ratios of Phosphoric Acid to Nitrogen on the Growth of Barley.** RANA BAHADUR (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 421—428).—Barley was grown in pots containing 8 kilos. of soil to which 5 grams of double superphosphate and 1.995, 5.985, 11.970, and 17.955 grams of ammonium nitrate were added. The ratios  $P_2O_5:N$  were, therefore, 3:1, 3, 6, and 9 respectively.

The greatest numbers of stems and ears and the greatest weights of ears and grain were obtained when the ratio  $P_2O_5:N$  was 3:3; the greatest weight of straw when the ratio was 3:6. The lowest results, both grain and straw, were with the ratio 3:9. An analysis of the grain of the best plants (No. 2) showed that the ratio  $N:P_2O_5$  was 100:37.3 (compare Stahl-Schröder, *J. Landw.*, 52, 80).

Further experiments were made in which a constant amount of ammonium nitrate (18 grams) was applied along with varying amounts of double superphosphate (5, 7.3, and 10 grams). The results of the experiment (which had to be discontinued before the flowering period) showed that the ratio  $P_2O_5:N=1:3$  was less favourable than the ratio 1:2 and that the considerable amount of ammonium nitrate applied was not injurious. N. H. J. M.

**Manuring with Kainite.** S. SUZUKI (*Bull. Coll. Agr. Tōkyō*, 1905, 6, 505—519).—Pot experiments with peas, buckwheat, rice, and beans showed that the application of kainite was favourable in every case. The conclusion is drawn that kainite can only act injuriously when the soil contains excessive amounts of chlorides or magnesium. N. H. J. M.

**Analyses of some Animal Excrements.** JOHN MCCRAE (*Chem. Zeit.*, 1905, 29, 364).—Analyses of some guano-like deposits found in the Transvaal and possessed of more or less manurial value. L. DE K.

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## Analytical Chemistry.

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**An Improved Gas Apparatus.** J. E. BABB (*J. Amer. Chem. Soc.*, 1905, 27, 156—158).—A modification of the Orsat apparatus, fully illustrated.

The apparatus has been constructed with a view to making a larger number of determinations. Its principal feature is an arrangement for bubbling the gases through the solutions. L. DE K.

**New Automatic Pipettes.** GREINER and FRIEDRICH (Zeit. angew. Chem., 1905, 18, 465).—A modification of the authors' well-known automatic pipette, enabling the overflow liquid to be returned readily to the pipette.

A doubly-acting pipette is also described, the tap of which is so constructed that one pipette is filled as the other is emptied.

L. DE K.

**New Burette for Volumetric Analyses.** W. N. IWANOFF (J. Russ. Phys. Chem. Soc., 1905, 37, 91—92).—This apparatus consists virtually of two burettes fixed side by side and having a common tap with two borings at right angles to one another, one for each burette, and also two separate nozzles. Two liquids may thus be titrated without removing the titration vessel from under the burette, so that time is saved. Besides this, the new arrangement only requires one stand and is hence more stable and occupies less space than two separate burettes and is cheaper to construct than the latter.

T. H. P.

**Crucible Refrigerator.** RUDOLF L. STEINLEN (Chem. Zeit., 1905, 29, 364—365).—When heating a mixture of a silicate with calcium carbonate and ammonium chloride over a blast (Lawrence Smith's method), in order to prevent volatilisation of alkali chlorides it is important that the lid shall not get overheated. For this purpose the author uses a small bottle-shaped vessel through which a current of water flows; this is suspended at half a mm. distance from the lid.

L. DE K.

**A New Filter.** PORTER W. SHIMER (J. Amer. Chem. Soc., 1905, 27, 287—292).—A convenient amount of Swedish filter-paper is crushed into a ball and placed in a ceresin-coated vessel and covered with hydrochloric acid of sp. gr. 1.12—1.18. A little hydrofluoric acid is added and the whole is stirred with a paraffin-coated wooden stirrer until the paper has turned into a mass of fine soft pulp, when distilled water is added. When a filter is required, some of this pulp is poured into a filter-tube of ordinary shape in the bottom of which is a rubber stopper fitted with a glass tube for attachment to the suction flask. On the stopper, when inserted into the tube, is a disc of piano-felt, 3/10 inch thick, fitting closely into the tube. The filter, if found to be of the desired thickness, is washed a few times with water and is then ready for use. When dealing with precipitates of barium sulphate and the like, the filter should be well compacted by hard stamping.

L. DE K.

**Estimation of Water in Foods and Physiological Preparations.** FRANCIS G. BENEDICT and CHARLOTTE R. MANNING (Amer. J. Physiol., 1905, 13, 309—329).—The errors entering into the determination of water by the usual methods are: (1) volatilisation of material other than water, (2) absorption of oxygen, and (3) abstraction of moisture from the air during the process of weighing. A description of various matters of technique to obviate

these errors is given; for instance, the use of vacuum desiccators and of a low temperature to minimise the loss first mentioned.

W. D. H.

**Estimation of the Halogens in Mercury Compounds.** THEOPHILE FISCHER (*Chem. Zeit.*, 1905, 29, 361—362).—About 0.5 gram of the bromide or chloride is heated in a Bunsen flask with 5 c.c. of 10 per cent. sodium hydroxide for 20 minutes. When cold, 3 c.c. of dilute sulphuric acid (1:1) is gradually added, and, after cooling, 0.4 gram of potassium permanganate suspended in 10 c.c. of dilute sulphuric acid. Without delay, the flask is connected with a suitable condensing arrangement and the halogen is boiled off and collected in a solution of potassium iodide. The liberated iodine is then titrated as usual.

The iodine contained in mercuric iodide may be conveniently estimated by treating the compound with magnesium powder in the presence of 10—20 c.c. of water. The filtrate contains magnesium iodide which is then precipitated with silver nitrate, &c. L. DE K.

**Estimation of Chlorine in Urine.** WILLIAM M. DEHN (*Zeit. physiol. Chem.*, 1905, 44, 11—16).—A modification of Volhard's method is recommended as rapid, accurate, and specially suitable for clinical work. A small quantity of sodium peroxide is added to 10 c.c. of urine, and the mixture evaporated on the water-bath; 10 c.c. of water and dilute nitric acid are successively added, until the reaction is distinctly acid. A little ferric nitrate is added as indicator, and then titration with potassium thiocyanate and silver nitrate is performed. The operation can be completed in two minutes.

W. D. H.

**Alkalimetric Estimation of Iodine.** GIUSEPPE BARBIERI (*Chem. Centr.*, 1905, i, 693; from *Boll. Chim. Farm.*, 44, 6—7).—Thirty c.c. of *N*/10 soda are mixed with 30—40 c.c. of a perfectly pure and neutral 1 per cent. hydrogen peroxide solution and 25 c.c. of the iodine solution to be tested. The colourless liquid is then heated for some minutes at 100° in order to decompose the excess of peroxide and the liquid titrated with *N*/10 sulphuric acid, using methyl-orange as indicator. The amount of alkali which has entered into combination with the iodine, multiplied by 3.1665, gives the free iodine in the 25 c.c. taken.

L. DE K.

**Estimation of Sulphur in Burnt Pyrites.** K. JENE (*Chem. Zeit.*, 1905, 29, 362).—The usual method still practised in many works is the wet process including precipitation with barium chloride without previous elimination of the iron.

The author states that a large proportion of the sulphur is retained in the insoluble residue and advocates the fusion with the oxidising mixture recommended by Fresenius, or treatment with sodium peroxide.

L. DE K.

**Estimation of Combined Sulphuric Acid by the Processes of Lunge and of Silberberger.** GEORG LUNGE (*Zeit. angew. Chem.*, 1905, 18, 449—460).—As the result of an analysis of a sample of iron



pyrites by twelve different analysts in various parts of Europe, it has been shown that the process devised by Lunge gives correct results in the assay of pyrites, and that Silberberger's strontium process should not be used. The following details should be attended to: the solution should be mixed with an excess of 5 c.c. of ammonia; after warming at 70° for 10—15 minutes, the ferric hydroxide is collected and washed with boiling water until the filtrate measures 500 c.c. After acidifying this with hydrochloric acid and then adding 1 c.c. in excess, the liquid is precipitated with barium chloride, as usual. L. DE K.

**Estimation of Sulphuric Acid by means of Benzidine Hydrochloride, and the Estimation of Sulphur in Pyrites.** GEORG VON KNORRE (*Chem. Centr.*, 1905, i, 628; from *Chem. Ind.*, 28, 2—13).—The benzidine method gives good results in the presence of ferrous, copper, cobalt, zinc, nickel, manganese, and aluminium compounds. Ferric salts, particularly ferric chloride, seem prejudicial, owing to oxidation of the benzidine. Reduction of the ferric compounds may be effected by means of hydrazine or hydrogen sulphide, and, when sufficient ammonium hydroxide is added to form a small permanent precipitate, by means of hydroxylamine hydrochloride. In the estimation of sulphur in pyrites, the addition of a small quantity of hydroxylamine hydrochloride to the benzidine solution eliminates the errors due to ferric iron. An excess of ammonium nitrate must be avoided. G. D. L.

**Oxidation of Sulphites by Iodine in Alkaline Solution.** R. HARMAN ASHLEY (*Amer. J. Sci.*, 1905, [iv], 19, 237—239).—Rupp has recently proposed to titrate sulphurous acid with iodine solution in the presence of sodium hydrogen carbonate. It is necessary to add an excess of iodine, which is then, in turn, titrated with sodium thiosulphate.

The author shows that the process gives results approximating to the truth, but that this is merely due to a balancing of errors. If the excess of iodine is titrated by means of arsenious acid, it will be found that the sulphite has been but incompletely oxidised. On the other hand, when titrating iodine with thiosulphate in an alkaline instead of an acid solution, less iodine will be found than is really present, and consequently the amount of iodine consumed by the sulphur dioxide will appear greater than it really is. L. DE K.

**Estimation of Ammonia in Milk.** W. N. BERG and HENRY C. SHERMAN (*J. Amer. Chem. Soc.*, 1905, 27, 124—136).—A slight modification of the Boussingault-Schaffer method originally devised for the estimation of ammonia in urine.

Fifty c.c. of the sample of milk are introduced into a 2-litre flask and, after adding 50 c.c. of methyl alcohol, mixed with 10 grams of salt and 0.5 gram of sodium carbonate. Should the milk be very acid, a suitable additional amount of alkali should be added. After connecting with the suction pump, the mixture is heated at 60—65°, and from 30—60 c.c. (usually between 45 and 55 c.c.) are distilled and collected in two receivers containing together 25 c.c. of N/20 sulphuric acid diluted with water to 40 c.c. The excess of

acid is then titrated by means of *N*/20 sodium hydroxide, using congo-red as indicator. As the presence of methyl alcohol affects the titration, the liquid should be measured before the final titration; the volume, less 40 c.c., gives the amount actually distilled over. The corresponding correction to be applied is 0.5 c.c. alkali for 30—39 c.c., 0.6 c.c. for 50—60 c.c. of distillate. Using this process, the distillate is practically free from albuminoid or cleavage ammonia.

There seems to be no fixed relation between the ammonia and the acidity.

L. DE K.

**Volumetric Method of Estimating Hydroxylamine.** LOUIS J. SIMON (*Compt. rend.*, 1905, 140, 724—727).—Hydroxylamine salts cannot generally be titrated directly with potassium permanganate, owing to the varying reducing effects of the acid with which the hydroxylamine is combined; if, however, an equivalent quantity of sodium oxalate is added to a solution of the hydrochloride, sulphate, or nitrate of hydroxylamine, the mixture behaves as if it were pure hydroxylamine oxalate and can be titrated exactly with potassium permanganate (compare Abstr., 1903, ii, 239). The result is not affected by the addition of excess of sodium oxalate, whilst a mixture of hydroxylamine nitrate and less than the equivalent quantity of sodium oxalate behaves like a mixture of the oxalate and nitrate of hydroxylamine, each independently reducing the permanganate. Slightly abnormal results are obtained (i) when the quantity of sodium oxalate in excess of the theoretical is very small; this is due to the action of the dilute solution of sodium oxalate on the reducing power of the hydroxylamine oxalate; (ii) when the total quantity of sodium oxalate added is small; this is due to the action of the hydrogen potassium oxalate on the reducing power of the hydroxylamine oxalate.

M. A. W.

**[Colorimetric] Estimation of Nitrogen as Nitrites in Waters.** ROBERT SPURR WESTON (*J. Amer. Chem. Soc.*, 1905, 27, 281—287).—The author approves of Ilosvay's modification of the Griess-Warrington method, in which the reagents are dissolved in acetic instead of hydrochloric acid. He thinks, however, that the process may still be further improved by making the solutions more concentrated, and suggests the following proportions: 8 grams of sulphanilic acid in 1 litre of acetic acid of sp. gr. 1.044 and 8 grams of  $\alpha$ -naphthylamine in 1 litre of acetic acid. Two c.c. of each of these reagents are to be added to 100 c.c. of the sample to be tested.

L. DE K.

**Diphenylamine as Reagent for Nitrites, Nitrates, Chlorates, and its use when mixed with Resorcinol and  $\beta$ -Naphthol.** EUGENIO P. ALVAREZ (*Chem. News*, 1905, 91, 155).—The colorations observed with diphenylamine are noted, but when 5 or 6 drops of a solution containing a decigram each of diphenylamine and resorcinol dissolved in 10 c.c. of sulphuric acid are poured on a milligram of nitrate, the liquid turns a yellowish-green with blue edges, becoming orange when alcohol is added. Nitrites give a deep bluish-violet with red margin, becoming red with alcohol. With chlorates, this mixture

is not satisfactory; when, however, the resorcinol is replaced by an equal weight of  $\beta$ -naphthol, a dull green coloration is obtained, which changes to grey or black when kept or when alcohol is added to it.

D. A. L.

**Estimation of Phosphorus in Phosphor-bronze.** DINAN (*Chem. Centr.*, 1905, i, 769; from *Mon. Sci.*, [iv], 19, 94).—Three to five grams of the alloy are dissolved in dilute nitric acid (1:1), and the insoluble tin oxide which retains the phosphoric acid is boiled with a solution of 7 grams of oxalic acid and 7 grams of ammonium oxalate until completely dissolved. The tin is deposited by electrolysis and in the liquid the phosphorus is estimated by the molybdate process, or, if preferred, by precipitation with magnesium citrate solution.

L. DE K.

**Colorimetric Estimation of Phosphorus [in Iron].** THOMAS E. HEWITT (*J. Amer. Chem. Soc.*, 1905, 27, 121—124).—The phosphomolybdate precipitate, obtained in the usual manner from 2 grams of pig-iron or steel, is washed with a 2 per cent. nitric acid and then dissolved in the smallest quantity of  $N/10$  sodium hydroxide. A further quantity of soda, one-half of that already used, is added, and the whole diluted to 100 c.c. An aliquot part is introduced into a 50 c.c. Nesslerising tube, and after passing a current of hydrogen sulphide for 5 minutes the tube is put into boiling water for another five minutes. After cooling and diluting to the mark, the colour is, as usual, compared with a standard solution treated with hydrogen sulphide in the same manner. This standard solution is made by dissolving 0.2737 gram of yellow precipitate in alkali, as directed, and diluting to 500 c.c.; 10 c.c. = 0.009122 mg. of phosphorus.

L. DE K.

**Estimation of Phosphoric Acid by the Method of Ignition with Magnesium Nitrate and by that of Digestion with Acids.** BURT L. HARTWELL, A. W. BOSWORTH, and J. W. KELLOGG (*J. Amer. Chem. Soc.*, 1905, 27, 240—244).—Before the molybdate process is applied, any organic matter should be completely destroyed, and this is effectually done by ignition with magnesium nitrate or in the wet way by heating in a Kjeldahl flask with sulphuric and nitric acids. The authors think that the most accurate estimations can be made by the ignition method, as the magnesium pyrophosphate obtained finally in the acid process is somewhat impure; this may, however, be partly remedied by redissolving the precipitate in nitric acid and reprecipitating with ammonia.

L. DE K.

**Estimation of Phosphoric Acid in Food-stuffs.** HENRI PELLET (*Ann. Chim. anal.*, 1905, 10, 93—95).—A reply to the criticism of Fleurent (*ibid.*, 12, 1904).

L. DE K.

**Detection of Arsenic by means of the Marsh Apparatus.** GEORG LOCKEMANN (*Zeit. angew. Chem.*, 1905, 18, 416—429).—An historical review of the various forms of the Marsh apparatus and



of the treatment of the substance to be examined therein. An illustration is given of an improved form as used by the author.

The best results are obtained with zinc which has been dipped for a minute in a 0.5 per cent. solution of pure copper sulphate and then washed. The author recommends drying the hydrogen evolved over *crystallised* calcium chloride.

L. DE K.

**Estimation of Arsenic in Fuels.** GEORGE MCGOWAN and R. B. FLORIS (*J. Soc. Chem. Ind.*, 1905, 24, 265—266).—The sample is ignited with lime to obtain the total arsenic and without lime to determine the non-volatile arsenic. The residues are dissolved in dilute hydrochloric acid, the arsenic is reduced by the addition of sulphurous acid and precipitated with hydrogen sulphide. The arsenic trisulphide is then collected on an asbestos filter and subsequently boiled out with water according to the method first described by F. Platten, who found that when arsenic trisulphide is boiled with water it is converted quantitatively into oxide, which remains in solution. The aqueous solution obtained is examined in a Marsh apparatus.

W. P. S.

**Interference of Mercuric Chloride with the Formation of Arsenic, Antimony, and Phosphorus Hydrides.** DIOSCORIDE VITALI (*Chem. Centr.*, 1905, i, 769; from *Boll. Chim. Farm.*, 44, 49—55).—Attention is called to the fact that owing to the formation of an arsenical mercury compound the presence of mercury, particularly in the form of mercuric chloride, may seriously interfere with the formation of arsenic hydride in the Marsh apparatus, most probably owing to the formation of Franceschi's compound,  $\text{AsHg}_2\text{Cl}_2 \cdot 3\text{H}_2\text{O}$ . The reaction may conversely be utilised for the detection of traces of mercuric chloride with which, on addition of zinc, hydrochloric acid, and arsenious acid, a yellow to brown coloration or a brown precipitate is obtained. The formation of antimony hydride or phosphorus hydride is also interfered with by the presence of mercury chloride.

L. DE K.

**Destruction of Organic Matters in Toxicological Investigations.** A. GRIGORÉEFF (*Chem. Centr.*, 1905, i, 771—772; from *Viertelsschr. ger. Med. öffent. Sanitätswesen*, 29, 74—78).—Ten grams (or more) of the dried substance are heated with 10 times the bulk of sulphuric acid until dissolved. It is then again heated with occasional addition of 10 c.c. of fuming nitric acid until fully oxidised. If much fat is present, 20 or 30 c.c. of nitric acid should be added from the commencement.

The nitric acid and the bulk of the sulphuric acid are then expelled by concentration to about 30 or 40 c.c., and the residue is finally diluted with 30 times its volume of water. The liquid is then ready for treatment with hydrogen sulphide, &c., or it may be at once introduced into the Marsh apparatus.

L. DE K.

**Detection and Estimation of Boric Acid in Butter.** M. MONHAUPT (*Chem. Zeit.*, 1905, 29, 362—363).—The usual plan is to saponify the butter with alcoholic potassium hydroxide and then to

test for boric acid in the ash as usual. For quantitative purposes, this process is, however, extremely inconvenient. The author recommends the following method.

A large quantity of the sample is shaken in a separating funnel, or in a wash-bottle, with water at 60°. The aqueous liquid is then removed, rendered alkaline with potassium hydroxide, and evaporated to dryness. The residue is ignited to destroy the organic matters and the ash is extracted with hot water. When cold, the solution is made up to a definite bulk, and in an aliquot part the boric acid is titrated by the glycerol method.

L. DE K.

**Estimation of Carbon in Ferrosilicon.** K. JENE (*Chem. Zeit.*, 1905, 29, 309).—The finely-powdered sample spread out in a thin layer is burnt with the usual precautions in a current of oxygen and the carbon dioxide formed is absorbed in a weighed potash-apparatus.

L. DE K.

**Estimation of Carbon Dioxide in Air.** W. MACKIE (*J. Hygiene*, 1905, 5, 201—222).—A handy method is described which gives better results than was anticipated. It depends on the view that equal quantities of alkali hydroxide in solution, of equal depth and surface area, will be neutralised by the carbon dioxide in a given atmosphere in equal times, and the times necessary for neutralisation will be inversely as the amounts of carbon dioxide in the atmosphere to which they are exposed. A number of equal spots of an alkaline solution coloured with phenolphthalein are exposed to the atmosphere under investigation, and the time required for decolorisation noted. If  $s$  is the strength of the solution,  $x$  the time in minutes of the discharge of colour,  $sf/x =$  vols. of carbon dioxide in 10,000 parts:  $f$  being a constant factor.

W. D. H.

**New Reagent for Potassium.** EUGENIO P. ALVAREZ (*Chem. News*, 1905, 91, 146).—When sodium 1-amino- $\beta$ -naphthol-6-sulphonate in saturated aqueous solution is shaken with solutions of potassium salts, brilliant, white, orthorhombic plates of the potassium salt separate—rapidly with 10 or 5 per cent. solutions of potassium chloride, but slowly with weaker ones, whilst more dilute solutions require some hours. Ammonium salts are not precipitated by the reagent, neither are magnesium salts in presence of excess of ammonium chloride.

D. A. L.

**Testing Effervescing Sodium Tartrate, so-called "Effervescing Citrate of Magnesia."** E. BARONI and G. B. GUIDI (*Chem. Centr.*, 1905, ii, 902—903; from *Giorn. Farm. Chim.*, 54, 49—52).—Ten grams of the sample introduced into a 4 cm.-wide 250 c.c. cylinder containing 90 c.c. of water at 15° should cause a lather reaching up to the 240 mark within 10 minutes. When treated with acids, 9 per cent. of carbon dioxide should be evolved. The sample should be free from reducing sugars, sulphates, borates, and [abroad] even from magnesium compounds.

L. DE K.

**Behaviour of Carbonates and Hydroxides towards Saturated Solutions of Potassium and Ammonium Carbonates.** CARL ARNOLD (*Ber.*, 1905, 38, 1173—1176).—On account of the varying statements in most analytical text-books, the author tabulates the solubility of the freshly precipitated carbonates and hydroxides of most of the common metals in saturated solutions of potassium and ammonium carbonates. A source of error has been the employment of solutions of ammonium carbonate containing too large a proportion of ammonium hydroxide.  
W. A. D.

**Estimation of Zinc in Blendes and other Natural and Artificial Products.** (The late) H. SALVIN PATTINSON and GEORGE C. REDPATH (*J. Soc. Chem. Ind.*, 1905, 24, 228—230).—Results obtained by three separate methods for the estimation of zinc in blendes, &c., are given, the object of the investigation being to show that the discrepancies which sometimes occur when the same sample is analysed by different analysts are mostly due to imperfect separation of the zinc, rather than to errors in the estimation itself. The authors prefer a modification of Von Schulz and Low's method, according to which the ore is treated with hydrochloric acid and evaporated to dryness after adding nitric acid. The residue is heated, cooled, and extracted with a solution containing 1 gram of ammonium chloride and 3 to 5 c.c. of ammonia for each gram of ore. The extracted residue is redissolved in hydrochloric acid, evaporated, and extracted a second time. If manganese is present, it is precipitated by adding bromine to the ammoniacal solution, collected on a filter, and redissolved in hydrochloric acid. Any zinc carried down with the manganese is precipitated from this acid solution by hydrogen sulphide in the presence of ammonium acetate. The zinc sulphide is then redissolved and added to the main solution, which is titrated with potassium ferrocyanide solution, using uranium acetate as indicator. Lewis's method (*Abstr.*, 1903, ii, 454) gives results agreeing with those obtained by the above process, as does also Von Berg's method, in which the ore is dissolved in hydrochloric and nitric acids, evaporated with sulphuric acid, and filtered. The filtrate is nearly neutralised with ammonia and ammonium carbonate is added until a permanent precipitate is obtained. The latter is just redissolved by sulphuric acid, ammonium chloroacetate and chloroacetic acid are added, and the zinc is precipitated with hydrogen sulphide.  
W. P. S.

**Lead in Pharmacopœial Chemicals.** CHARLES A. HILL (*Chemist and Druggist*, 1905, 66, 388—391).—The following quantities of lead were found in samples of "purest" chemicals, the results being expressed in parts per million : phosphoric acid of sp. gr. 1.75, 1 to 14 ; hydrochloric acid, 1 to 6 ; nitric acid, 1 to 75 ; sulphuric acid, usually less than 15 but occasionally more ; acetic acid, 0 to 3 ; potassium acetate, traces ; sodium acetate, heavy traces ; ammonium carbonate, up to 120 ; borax, 1 to 12 ; boric acid, 2 to 50 ; tartaric acid, 4 to 10 ; citric acid, usually less than 5 ; potassium hydrogen tartrate, mere traces to 4 ; potassium sodium tartrate, 5 to 10 ; magnesium oxide (light), 10 to 30 ; magnesium oxide (heavy), 30 to 300 ; magnesium



carbonate (light), 8 to 20 ; magnesium carbonate (heavy), 20 to 200 ; magnesium sulphate, 2 to 6 ; other sodium and potassium salts, 0 to 15 ; glycerol and lactic acid, none.

W. P. S.

**Detection and Estimation of Lead in Cream of Tartar.** L. and J. GADAIS (*Ann. Chim. anal.*, 1905, 10, 98—101).—Five hundred grams of the sample are dissolved in 400 c.c. of water and 300 c.c. of pure hydrochloric acid and, after adding 0.15 gram of copper in the form of nitrate, the metals are precipitated by a current of hydrogen sulphide. The sulphides are collected and washed and then dissolved in 8 c.c. of nitric acid. The whole is diluted with water, boiled, filtered, and evaporated to about 25 c.c. After transferring to a suitable apparatus and diluting with another 25 c.c. of water, the liquid is submitted to electrolysis.

The lead deposits as peroxide on the anode and may be weighed as such. It may be identified by the fine blue colour generated on moistening with an acetic acid solution of tetramethyldiaminodiphenylmethane. For a mere qualitative test, it is sufficient to operate on only 100 grams of the sample.

L. DE K.

**Assay of White Metal.** DINAN (*Chem. Centr.*, 1905, i, 770 ; *Mon. Sci.*, [iv], 19, 92—94).—One gram of the alloy is oxidised with nitric acid, the dry residue is moistened with nitric acid and boiled with water. The insoluble residue is boiled with 150 c.c. of water, 7 grams of oxalic acid, and 7 grams of ammonium oxalate for 45 minutes. The turbid liquid is then diluted to 250 c.c. and treated at 90—95° for 2—3 hours with a current of hydrogen sulphide. The tin which remains in solution is recovered by electrolysis after expelling the hydrogen sulphide and adding another 10 grams of oxalic acid.

The sulphides are boiled with 15 c.c. of water and 2 grams of potassium hydroxide ; the antimony dissolves and is recovered electrolytically after adding 50 c.c. of a saturated solution of sodium monosulphide.

The undissolved sulphides of copper and lead are treated as usual, the lead being separated as sulphate and the copper being recovered from the filtrate by electrolysis after addition of nitric acid.

L. DE K.

**Estimation of Acids combined with Aluminium.** OTTO SCHMATOLLA (*Ber.*, 1905, 38, 985—989).—It is shown that slightly different results are obtained by titrating a solution of aluminium sulphate with sodium carbonate and with sodium hydroxide respectively ; in the latter case, a small proportion of the sulphuric acid is retained by the precipitated aluminium hydroxide in the form of a basic sulphate. The influence of neutral salts on the titration is also discussed. The best procedure seems to be to titrate the aluminium sulphate solution with sodium carbonate, maintaining the solution at the boiling point throughout, phenolphthalein being employed as indicator ; allowance has to be made for the small quantity of sulphuric acid retained by the precipitate, which is a constant quantity. In the case of the acetate, nitrate, and chloride, on

account of the volatility of the acid, an excess of the alkali is added, the excess being then estimated. W. A. D.

**Qualitative Reactions for Columbium and Tantalum.** PETR G. MELIKOFF and EUGEN ELTSCHANINOFF (*J. Russ. Phys. Chem. Soc.*, 1905, **37**, 99—103).—The potassium salt of fluoropercolumbic acid, in presence of a small quantity of hydrogen peroxide, is coloured yellow by sulphuric acid. A concentrated aqueous solution of potassium percolumbate is coloured yellow by 60—70 per cent. sulphuric acid. These reactions render it possible to detect traces of columbium in tantalum preparations. T. H. P.

**Estimation of Bismuth by Precipitation as Molybdate.** EDMUND H. MILLER and FREDERICK VAN DYKE CRUSER (*J. Amer. Chem. Soc.*, 1905, **27**, 116—121).—The nitric acid solution of the bismuth is mixed with a large excess of the ordinary ammonium molybdate reagent and the liquid is neutralised with dilute ammonia, using congo-red as indicator; a drop or two of dilute nitric acid is then added until the colour is lilac. The whole is diluted to about 200 cc. and slowly heated to 50—60°. The precipitated bismuth ammonium molybdate is collected on a platinum Gooch crucible and thoroughly washed with a 3 per cent. solution of ammonium nitrate. After drying in an air-bath at 160°, the precipitate is moistened with a few drops of strong nitric acid and ignited over a bunsen flame, taking care the temperature does not exceed a dull red heat. The treatment with acid and subsequent ignition being repeated a few times, the mass will be of a light yellow colour, and have the composition  $\text{Bi}_2\text{O}_3 \cdot 4\text{MoO}_3$ . L. DE K.

**Optical Examination of Naphtha and of its Distillation Products.** II. M. A. RAKUSIN (*J. Russ. Phys. Chem. Soc.*, 1905, **37**, 85—91).—The rotatory power may be used as a means of distinguishing different naphthas from one another, and also from vegetable and animal oils. The rotation of naphtha products increases with the sp. gr., and all fractions up to machine oil can be read in a 200 mm. tube if they are pure. This method of examination hence possesses the character of a colorimetric method. The rotation of naphtha products represents a well-defined physico-chemical constant, and is unaffected by the action of heat or time. Purification diminishes to some extent the rotation of crude naphtha distillates. The rotations of a number of light and dark naphthas both of Baku and Grosny origin have been measured and the numbers tabulated. T. H. P.

**Detection and Estimation of Fusel Oil.** T. TAKAHASHI (*Bul. Coll. Agr. Tōkyō*, 1905, **6**, 436—438).—The liquid (4—6 c.c.) is treated with 5—10 drops of a 1—2 per cent. alcoholic solution of benzaldehyde, anisaldehyde, or *o*-hydroxybenzaldehyde, and then with an equal volume of sulphuric acid. In presence of fusel oil, benzaldehyde gives a red colour above a yellow layer; anisaldehyde, brownish-yellow under green and yellow layers, the former changing to red, the latter

to blue and brownish-purple; *o*-hydroxybenzaldehyde gives a red layer with a purple layer above.

For estimating the amount of fusel oil, the liquid (10 c.c.) is poured into a small cylinder and treated with 2 c.c. of 1 per cent. anisaldehyde in alcohol and 20 c.c. of sulphuric acid. A solution of fusel oil of known strength in 15 per cent. alcohol is similarly treated. The colours produced at intervals of 20 seconds, 1, 3, and 10 minutes are observed. A table is given showing the differences when 0·0001, 0·001, 0·01, and 0·1 per cent. of fusel oil are present (compare Komarowski, *Abstr.*, 1903, ii, 700).

N. H. J. M.

#### Colorimetric Estimation of Higher Alcohols in Brandies.

XAVIER ROCQUES (*Ann. Chim. anal.*, 1905, 10, 103—108. Compare *Compt. rend.*, 140, 511).—In this method, which depends on the colour developed by the higher alcohols when heated in alcoholic solution with sulphuric acid, the mixture should be heated at 130°, as at this temperature identical colorations are obtained with *isobutyl* and *amyl* alcohols, whilst considerable divergences occur at lower temperatures.

L. DE K.

**New General Colour Reagent of the Polyphenols, their Isomerides, and Higher Organic Compounds.** EUGENIO P. ALVAREZ (*Chem. News*, 1905, 91, 125).—0·4—0·5 gram of the polyphenol is added to 0·2 gram of yellow, granulated, perfectly dry sodium peroxide in a porcelain dish and treated with 5 c.c. of absolute alcohol; the dish is gently agitated, the colour effects noted, and after 5 or 6 minutes 15 c.c. of cold water are added. Catechol gives a fugitive pale pink, changing into green and finally brown, and with water the liquid becomes permanently reddish-brown. Resorcinol assumes a very pale yellow, turning green, which becomes more decided and permanent with water. Quinol produces an intense reddish-yellow which the water changes to a persistent orange. Pyrogallol shows a reddish-brown or dull red, becoming intense red with a yellow margin when water is added, and changing to orange in 24 hours. Hydroxyquinol gives a reddish-violet which deepens and turns brown, whilst the peroxide blackens; with water, the liquid becomes yellow. Phloroglucinol develops a bluish-violet, which increases in intensity with water, but subsequently fades. Orcinol yields pink, becoming persistent rose-red with water. Homocatechol colours the alcohol bluish-violet which changes at once to red, and with water, to reddish-brown with a yellow margin. With thymoquinol, the alcohol assumes an orange colour which with water turns red and slowly fades. Some incidental effects are also noted.

D. A. L.

**Estimation of Dextrose in Urine.** H. L. VISSER (*Chem. Centr.*, 1905, i, 776; from *Pharm. Weekblad.*, 42, 121—124).—The urine is first clarified by means of basic lead nitrate and 10 c.c. of the filtrate are then boiled with 2 c.c. of Fehling's solution. The cuprous oxide is collected on a cotton-wool filter and weighed as such.

L. DE K.



**Reactions of Carbohydrates.** RUDOLF ADLER and OSKAR ADLER (*Pflüger's Archiv*, 1905, 106, 323—328).—The characteristic red coloration due to furfurylaniline acetate is obtained when a small amount of a pentose is added to a boiling mixture of equal parts of aniline and glacial acetic acid. This serves as a simple qualitative test for pentoses, as other carbohydrates do not give this coloration in the course of a short time. The heptoses are exceptional in their behaviour as they also yield furfuraldehyde and therefore give a red coloration.

Seliwanoff's red coloration (Abstr., 1887, 459) is also obtained when lævulose or any ketose is warmed for a short time with resorcinol and acetic acid containing a few drops of hydrochloric acid. The reaction is much more trustworthy than the original test, as aldoses do not give a coloration under these conditions.

Similarly Tollens' reactions with orcinol or phloroglucinol may be carried out with hot acetic acid solutions containing a few drops of hydrochloric acid.

When dextrose is heated with aniline and acetic acid, a reddish-brown coloration is developed, and this on further heating changes to an intense green. A similar reaction appears to be given by all hexoses or polysaccharides, which readily yield hexoses.

Other bases may be substituted for aniline, and different colorations are thus obtained. J. J. S.

**Detection of Sawdust in Flour and Bread.** PIETRO PAGANINI (*Chem. Centr.*, 1905, i, 695—696; from *Giorn. Farm. Chim.*, 54, 5—11).—The flour is spread out in a thin layer and moistened first with a 0.2 per cent. aqueous solution of *p*-phenylenediamine and then with acetic acid. The woody fragments at once assume an orange-red colour, whilst the bran fragments remain colourless. The test is also applicable to adulterated maize flour and to thin slices of bread. L. DE K.

**Estimation of Acetone by the Iodoform Process.** GUSTAV KEPPELER (*Zeit. angew. Chem.*, 1905, 18, 464—465).—In reference to an article by Vaubel and Scheurer (this vol., ii, 291), the author states that Messinger's process is quite satisfactory if the following points are observed. The iodine solution should be added slowly with constant stirring and in decided excess, and some 5 minutes should elapse before titrating with thiosulphate. L. DE K.

**Analysis of Wine Vinegar.** A. FRÖHNER (*Zeit. Nahr. Genussm.*, 1905, 9, 361—363).—Analyses of three samples of wine vinegar are given, the results on the whole agreeing with those previously published by Farnsteiner (Abstr., 1899, ii, 705). Lactic acid is generally a constituent of this class of vinegar, and its detection and determination serve as criteria in ascertaining whether or not a vinegar is wine vinegar. The amounts of lactic acid found in the above-mentioned samples were 0.221, 0.247, and 0.215 gram per 100 c.c., whilst the total acidities (as acetic acid) were 8.47, 9.03, and 7.83 respectively. W. P. S.

**Estimation of Volatile Acids in Wine.** KARL WINDISCH and THEODOR ROETTGEN (*Zeit. Nahr. Genussm.*, 1905, 9, 278—279).—Methods which depend on the prolonged evaporation of the wine, or in which the residue is heated to a high temperature (Abstr., 1879, 290; 1882, 999, 1235), the volatile acids being obtained by difference, give untrustworthy results. Direct distillation in a current of steam yields better results (Abstr., 1884, 641), but the process is tedious owing to the slow volatility of certain of the acids present in wine. Attention is again drawn to the indirect method recently published (Abstr., 1905, ii, 212) for estimating these acids. W. P. S.

**Volatility of Lactic Acid with Water Vapours.** FRANZ URTZ (*Chem. Zeit.*, 1905, 29, 363—364).—The author has proved experimentally that lactic acid is volatilised with aqueous vapours, particularly when the solutions become more concentrated, but this volatility is not sufficient to admit of a quantitative estimation of the acid. L. DE K.

**The Composition of Lombardy Milk.** G. BILLITZ (*Milchw. Zentr.*, 1905, 1, 113—122).—A regulation having recently (1902) been made at Milan that all milk sold shall contain at least 12 per cent. of dry solids, consisting of 3 per cent. of fat and 9 per cent. of non-fatty solids, or else be described as “watered” milk, the author gives the results of analyses of 187,610 samples of Lombardy milk, the investigation extending over the years 1892—1902 inclusive. The average results for the whole period were: sp. gr., 1.0315; fat, 3.55 per cent.; non-fatty solids, 8.81 per cent. The poorest milk was yielded by a herd of 50 cows in March, 1899, the results being: sp. gr., 1.0306; fat, 2.70 per cent.; non-fatty solids, 8.45 per cent.; whilst the richest milk was obtained in December, 1902, from a herd of 80 cows: sp. gr., 1.0326; fat, 4.10 per cent.; non-fatty solids, 9.23 per cent. From this it will be seen that the limits laid down by the Milan authorities are too stringent. W. P. S.

**Amount of Water in Butters of Various Origin, and their Reichert-Meissl Numbers.** HERMANN THEODOR (*Chem. Zeit.*, 1905, 29, 309).—A table giving the percentage of water contained in butters of various origin. As regards their Reichert-Meissl number, the lowest of which (25) is given by a Dutch butter, it must be remembered that the English method gives results which are about one degree below those obtained by the German process. L. DE K.

**Sinacid-Butyrometry.** MOLKEREITECHN. INST. SICHLER & RICHTER, LEIPZIG (*Milchw. Zentr.*, 1905, 1, 71—78. Compare Du Roi and Köhler, this vol., ii, 125).—A reply to various criticisms of the method, which is stated to be trustworthy and rapid. N. H. J. M.

**Influence of the Duration of Boiling on the Saponification Value of Beeswax.** SCHWARZ (*Zeit. öffentl. Chem.*, 1905, 11, 6—8).—The results of the experiments described show that, by boiling 3 grams of beeswax with 25 c.c. of  $N/2$  alcoholic potassium hydroxide

solution for 1 hour, complete saponification is effected, and that no advantage is gained by prolonging the time of boiling to 2 or 3 hours. Boiling for 1 hour is sufficient even when the wax is adulterated with solid paraffin. A further quantity of neutral alcohol should be added before titration to prevent dissociation by the standard acid employed. This addition of alcohol is also necessary when the saponification value is determined by Henrique's cold saponification process. W. P. S.

**Bromine Absorption of Fats.** FERNAND TELLE (*J. Pharm. Chim.*, 1905, 21, 183—187).—Bromine absorption of fats and oils is recommended instead of iodine absorption, as the former is not only more easy of execution, but gives constant and trustworthy results. A table is given containing the bromine figures of 25 oils and fats.

L. DE K.

**Detection of Palm Oil when used as a Colouring Matter in Oils and Fats.** CHARLES A. CRAMPTON and FRANK D. SIMONS (*J. Amer. Chem. Soc.*, 1905, 27, 270—274).—The authors communicate two methods for the detection of palm oil, or rather of its colouring matter, in fats and oils.

*First Method.*—One hundred c.c. of the fat (melted at 70° and filtered) are dissolved in 300 c.c. of light petroleum and shaken with 50 c.c. of 0.5 per cent. potassium hydroxide. The aqueous solution is drawn off, acidified with hydrochloric acid, and shaken with 10 c.c. of carbon tetrachloride. A portion of this is then tested as follows: two c.c. of 1 part of crystallised phenol dissolved in 2 parts of carbon tetrachloride are added to it in a porcelain crucible and 5 drops of hydrobromic acid of 1.19 sp. gr. are stirred in. The almost immediate development of a bluish-green colour is indicative of palm oil.

*Second Method.*—Ten c.c. of the melted and filtered fat are shaken with an equal volume of acetic anhydride; a drop of sulphuric acid of sp. gr. 1.53 is added, and the whole shaken for a few seconds. If palm oil is present, the lower layers will be found to be coloured blue with a tinge of green.

L. DE K.

**Analysis of India-rubber Wares.** WERNER ESCH and ABRAHAM CHWOLLES (*Chem. Centr.*, 1905, i, 190; from *Gummi Zeit.*, 19, 125—126).—A criticism of Pontio's method (*Ann. Chim. anal.*, 1902, 7, 13). It is not advisable to substitute alcohol for acetone, as it dissolves but little of the unsaponifiable fats. In order to dissolve any asphalt, Henriques and Weber use nitrobenzene, whilst Pontio uses a mixture of 60 parts of oil of spike and 40 parts of acetone; the authors cannot approve of this solvent. They also call attention to an error in the literature and state that Pontio's solvent used for the extraction of vulcanised india-rubber consists of 85 per cent. of sulphur-free petroleum and 15 per cent. of benzene.

L. DE K.

**Detection and Estimation of Bitumen in Gutta Percha.** MAURICE PONTIO (*Ann. Chim. anal.*, 1905, 10, 57—58).—After digesting the sample of gutta percha in absolute alcohol to ascertain the amount of resins, it is extracted in a suitable apparatus



for 12 hours with boiling ether and the residue is then collected, dried, and weighed. If the sample contains bitumen, the residue contains the natural impurities of the gutta *plus* 62/100ths of the added bitumen. To see whether this is really present, the mass is further extracted with carbon disulphide or boiling toluene and by reweighing the undissolved matter the bitumen is found by difference. Its weight multiplied by 100/62 represents the total bitumen.

L. DE K.

**Estimation of Quinine in Cinchona Barks.** VIGNERON (*J. Pharm. Chim.*, 1905, 21, 180—183).—The mixed alkaloids, obtained as usual from 25 grams of bark, are treated with twenty times their weight of ether, about six small pieces of pumice soaked in alcohol are added, and the whole is kept for 6 hours with occasional shaking. The ether is decanted on to a filter and the residue extracted again with the same volume of fresh ether for 12 hours. The mixed ethereal solutions are allowed to evaporate, and the residue is dissolved in 5 c.c. of alcohol and 100 c.c. of water previously saturated with quinine sulphate. The whole is heated on the water-bath to expel the alcohol and ether, and during this time the alkaloids are converted into normal sulphates by neutralisation with normal sulphuric acid, using tincture of logwood as indicator.

When cold, the separated quinine sulphate which, however, generally contains some cinchonidine sulphate, is collected, washed with solution of quinine sulphate, dried at  $100^{\circ}$ , and weighed as anhydrous sulphate. To ascertain the true amount of quinine, an aliquot portion is dissolved in hot water previously saturated in the cold with quinine chromate, and precipitated according to De Vrij's method with potassium chromate. Seventy-six parts of quinine chromate dried at  $100^{\circ} = 75$  parts of the dried sulphate. The filtrate should be tested with sodium hydroxide to ascertain whether cinchonidine is really present.

L. DE K.

**Estimation of the Active Principles of Alder Bark.** JULES WARIN (*J. Pharm. Chim.*, 1905, 21, 253—263).—The principle of the method is as follows: when treating the powder of alder bark with a half per cent. solution of sodium hydroxide, a red solution is obtained, which may then be compared colorimetrically with an alkaline solution of emodin of known strength. Better results are, however, obtained by diluting a measured portion of the alkaline solution to such an extent that its colour is no longer visible when viewed through a solution of nickel chloride placed in another tube of the same size. This nickel solution contains exactly 1 gram of metallic nickel in 100 c.c., and neutralises the colour of 0.001 gram of emodin dissolved in 100 c.c. of alkaline water. For minute particulars necessary to ensure success, the original article should be consulted. The result gives the valuable constituents expressed as emodin.

L. DE K.

**Analysis of Tanning Materials with Exfoliated Alumina.** HANS WISLICENUS (*Zeit. anal. Chem.*, 1905, 44, 96—106).—The voluminous alumina obtained by the atmospheric oxidation of amal-

ganated aluminium possesses the property of removing from solution 25—45 per cent. of its weight of tannin, and may therefore be used with advantage in place of hide powder. The tannin precipitate is not decomposed by washing with hot water, alcohol, or ether; on the other hand, the sugars and other non-tanning constituents of an extract are easily washed out. The alumina can be regenerated by incinerating the precipitate, and its adsorptive power is not impaired by ignition. The amount of tannin precipitated cannot be ascertained by weighing the precipitate, but is obtained by difference from the dry residues of the solution before and after precipitation. Duplicate estimations with this precipitant show greater concordance than is attainable with hide powder. In preparing the alumina, the presence of water should be avoided as far as possible, and the oxide should finally be separated from unoxidised metal by elutriation with ether. It is ignited before use. M. J. S.

**Preparation and Estimation of Lecithin.** HERBERT E. ROAF and E. S. EDIE (*Thompson, Yates, and Johnston Lab. Rep., Liverpool*, 1905, 6, 201—205).—Egg yolks are repeatedly extracted with alcohol; the alcohol from the united extracts is distilled off under reduced pressure. To the syrupy mass so obtained, a little ether is added and the liquid precipitated with acetone. The precipitate is heated on a steam-bath to remove ether and acetone and weighed, or the lecithin in it determined by phosphorus estimation. W. D. H.

**Estimation of Albumin in Barley.** R. HEERDE and E. BUSCH (*Chem. Centr.*, 1905, i, 299—300, 300; from *Woch. Brauerei*, 21, 779—780, 830—832).—Using the whole grains for Kjeldahl's method leads to serious discrepancies. The barley should therefore be ground to a fine flour, of which 2 grams are taken for analysis. After heating with 30 c.c. of sulphuric acid and 1 gram of mercury for 10 minutes, 15 grams of potassium sulphate are added. The mixture requires boiling for 35 minutes. When distilling off the ammonia, the receiver should be kept very cool, so as to prevent loss of ammonia.

NEUMANN states that there is no loss of ammonia even if the contents of the receiver should get overheated. On using a large Jena glass flask, there is no need for transferring the acid liquid to another distilling flask.

In the later papers, the respective authors reaffirm the antagonistic views put forth in the first. L. DE K.

## General and Physical Chemistry.

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**Chemistry of Phosphorescing Sulphides of the Alkaline Earths.** PERCY WAENTIG (*Zeit. physikal. Chem.*, 1905, 51, 435—472. Compare Abstr., 1903, ii, 625).—The author's experiments confirm the view that the marked phosphorescence exhibited by the sulphides of the alkaline earths is conditioned by the presence in solid solution of a small quantity of certain heavy metals. A purified sample of strontium sulphide has been obtained exhibiting only a very faint blue phosphorescence, and this residual phosphorescence was traced to the presence of iron. Platinum, even in traces, also appears to have the power of causing phosphorescence in the sulphides of the alkaline earths. The intensity of the phosphorescence increases with the concentration of heavy metal present so long as the latter is dissolved to a homogeneous solid solution. The solubility of these heavy metals increases with rising temperature, and is very small at the ordinary temperature; all phosphorescing sulphides, therefore, which have been obtained by heating an alkaline earth carbonate and sulphur with the nitrate or sulphate of the heavy metal are to be regarded at the ordinary temperature as supersaturated solutions. Hence many factors are to be considered in the preparation of a highly phosphorescent sulphide, such as the temperature at which the sulphide is to be prepared, the duration of the heating, and the rate of cooling. Allowing for the influence of these various factors, the author has prepared sulphides, the phosphorescent efficiency of which is greater than that of the products obtained by the usual methods. The presence of a small quantity of a fusible salt is favourable for the production of a highly phosphorescent sulphide, because (1) it promotes the solution of the heavy metal in the sulphide, (2) it hinders the separation of the heavy metal during the process of cooling.

When the sulphides of the alkaline earths are ground in a mortar, they become coloured and lose, to a large extent at least, their phosphorescent power. The colour assumed varies with the sulphide used, and depends neither on the heavy metal present nor on the original phosphorescence colour. The coloured powder is unstable compared with the original white phosphorescent material. The change can be effected in either direction at one and the same temperature.

Intermittent illumination over a period of several months does not apparently lead to any diminution of phosphorescent power: so far, therefore, there is no indication that a chemical change is involved.

J. C. P.

**The Light emitted by Crystals of Arsenious Oxide.** DESIRÉ GERNEZ (*Compt. rend.*, 1905, 140, 1134—1136).—The luminous effect which accompanies the formation of octahedral crystals of arsenious oxide from hydrochloric acid solutions of the vitreous variety is due to the rupture of the crystals induced by contact with one another, and



can be produced artificially by crushing the crystals against the walls of the vessel with a metal rod; the phenomenon is therefore one of triboluminescence. The author finds that triboluminescent crystals are deposited from hydrochloric acid solutions of vitreous arsenious oxide made at the ordinary temperature or from hydrochloric acid solutions of the ordinary powdered octahedral arsenious oxide made at boiling point (compare Guinchant, following abstracts), and, provided they remain unbroken, the crystals retain this property for a period of over four months.

M. A. W.

**Luminescence of Arsenious Oxide.** JOSEPH GUINCHANT (*Compt. rend.*, 1905, 140, 1101).—The luminescence of arsenious oxide depends solely on the concentration of hydrogen chloride in the liquid, and is to be attributed to the reversible chemical change,  $\text{As}_2\text{O}_3 + 6\text{HCl} = 2\text{AsCl}_3 + 3\text{H}_2\text{O}$ .

H. M. D.

**Triboluminescence of Arsenious Oxide.** JOSEPH GUINCHANT (*Compt. rend.*, 1905, 140, 1170—1171. Compare preceding abstracts).—The luminescence of arsenious oxide crystals is due to the rupture attending their transformation into the cubic modification, and has no action on an electroscope. The light thus produced gives a continuous visible spectrum in which the yellow and green radiations predominate; these radiations are photochemically active, producing in four minutes, at a distance of a few centimetres, the same photographic effect as the blue flame of a Bunsen burner at a distance of one metre.

The rest of the paper is occupied with a description of the luminous phenomena which are produced when hypobromites or hypochlorites are reduced by carbamide, oxamide, ammonium thiocyanate, asparagine, uric acid, or ammonia under suitable conditions of concentration. The light emitted has feeble photochemical properties and arises from the explosive decomposition of the nitrogen chloride which is formed during the first phase of the reaction between carbamide and a hypochlorite. If concentrated solutions of hypochlorous acid and carbamide are mixed, there is no immediate action, but after a few minutes oily drops of nitrogen chloride are formed, which in the presence of oil of turpentine explode with an evolution of light, and the decomposition is also brought about by alkalis.

The bubbles of hydrogen evolved when sodium amalgam is thrown into a concentrated solution of sodium hypobromite are surrounded by a luminous zone.

M. A. W.

**Radioactivity as an Atomic Property.** HERBERT N. MCCOY (*J. Amer. Chem. Soc.*, 1905, 27, 391—403).—A number of experiments are described in which measurements of radioactivity of uranium compounds were carried out by means of the electroscope. The compounds examined were the oxide,  $\text{U}_3\text{O}_8$ , the oxalate,  $\text{UO}_2\cdot\text{C}_2\text{O}_4\cdot 3\text{H}_2\text{O}$ , and ammonium uranate,  $(\text{NH}_4)_2\text{U}_2\text{O}_7$ . The results are plotted as curves, and show that the effective activity of layers of uranium compounds of sufficient thickness to show the maximum  $\alpha$ -ray activity depends not only on the uranium content, but also on the coefficient of absorption of the rays by the radioactive substance itself. A method

has been worked out for the determination of such absorption coefficients. It is shown that, when absorption is taken into account, the total  $\alpha$ -ray activity of any uranium compound is strictly proportional to the percentage of uranium which it contains, and the theory that radioactivity is an atomic property is thus confirmed.

E. G.

**Properties of Radium in Minute Quantities.** A. S. EVE (*Phil. Mag.*, 1905, [vi], 9, 708—711).—Voller found recently (see *Physikal. Zeit.*, 1904) that radium distributed on a plate in minute quantities and exposed to the air disappeared and decayed in a few days or weeks, and that the activity of radium thinly distributed over a small surface was not proportional to the mass present, but was relatively greater for small quantities. The author shows that when similar experiments are made in a closed vessel, no disappearance can be detected, and the activity is at least approximately, and probably accurately, proportional to the mass present.

A supplementary note by ERNEST RUTHERFORD (*ibid.*, 711—712) emphasises these points, and suggests that the decrease of activity observed by Voller has nothing to do with any actual change in the rate of disintegration of the radium, but is due to the escape of the radium from the plate into the surrounding gas. A similar loss would probably be observed even with inactive matter if it were deposited in such minute amount.

J. C. P.

**The Constant for the Rate of Decay of Radium Emanation.** OTTO SACKUR (*Ber.*, 1905, 38, 1753—1756. Compare Curie, Abstr., 1903, ii, 50; Rutherford, *ibid.*, 347).—Curie finds that the constant for the rate of decay of the radium emanation is  $2.02 \times 10^{-6}$ , whereas Rutherford gives  $2.16 \times 10^{-6}$ . The author has measured the rate of decay by the method of Rutherford and Soddy, and finds the value  $2.08 \times 10^{-6}$ . The activity of the emanation diminishes in 92.6 hours to one-half of its original value.

A. McK.

**Radioactivity of the Gastein Thermal Springs.** HEINRICH MACHE (*Monatsh.*, 1905, 26, 349—372. Compare Curie and Laborde, Abstr., 1904, ii, 461; Elster and Geitel, Abstr., 1904, ii, 695).—The radioactive emanation obtained in varying, but mostly considerable, amount from the gases and water of the Gastein thermal springs, a list of which is given, has a rate of decay which is approximately equal to that of the radium emanation, as is also that of the induced radioactivity to the activity induced by radium emanation. The radioactive substance which produces the emanation obtained from the gases and water is found in the reissacherite of the deposits from the thermal springs. This mineral, which has a radioactivity approximately equal to that of uranyl nitrate, contains manganese dioxide, ferric oxide, calcium carbonate, barium, and strontium, but neither sulphuric acid nor uranium; on separation, the radioactive substance is obtained along with the barium and is presumably radium.

G. Y.

**Radioactivity of some Deep Well and Mineral Waters.** HERMANN SCHLUNDT and RICHARD B. MOORE (*J. Physical Chem.*, 1905, 9, 320—332).—The authors have tested the radioactivity of a number of deep well waters and expressed the values by means of the standard suggested by Boltwood (*Abstr.*, 1904, ii, 666), that is, in terms of the unit representing the amount of radium emanation associated with  $1 \times 10^{-4}$  grams of uranium in a natural mineral. The emanation dissolved in the water was obtained by boiling the water and collecting the dissolved gas. The values for the radioactivity obtained varied from 0.17 to 4.45 units per litre of water. It was found from the rate of decay that the radioactive properties were due to radium emanation. It was also found that a little less than one-half the total emanation was liberated before boiling, this being also the case for water rendered active by radium emanation. L. M. J.

**Excited Activity of Thorium.** Miss J. M. W. SLATER (*Phil. Mag.*, 1905, [vi], 9, 628—644).—The results of the investigation are summarised as follows. The two stages in the disintegration of thorium-excited activity, the existence of which has been already indicated by theoretical considerations, are both present on any surface exposed to thorium emanation. The constituent with the slower rate of decay (half value in 11 hours) is first formed, and may be referred to as thorium *A*. The thorium *B* formed from it is responsible for the radiation emitted, and has a more rapid rate of decay (half value in 55 minutes). Both substances are partly volatilised on exposure to the cathode ray discharge, thorium *B* being more volatile than thorium *A* in these circumstances. The cause of the volatilisation is partly a direct action of the cathode rays, and partly a sputtering of the active matter, analogous to that observed with metallic cathodes. Under the influence of heat, thorium *A* is more volatile than thorium *B*; when an active wire is kept for a few minutes at a dull red heat, the former constituent is removed and nearly pure thorium *B* is then left on the wire. J. C. P.

**Radioactivity of Thorium.** OTTO SACKUR (*Ber.*, 1905, 38, 1756—1761).—The author has measured the rate of decay of the emanation of the product obtained by Hahn by the fractionation of radium barium bromide, and from the values obtained concludes that thorium emanation was evolved from a new radioactive element present in Hahn's product.

The possibility of thorium itself being inactive, whilst its radioactivity is due to the presence of some other substance, is discussed.

The oxalate obtained from thorianite was converted into oxide and then into chloride, which, when submitted to fractional sublimation, did not indicate any separation of the radioactive component.

Barium hydroxide solution was gradually added to a solution of the sulphate obtained from the oxalate and the precipitated barium sulphate was found to be strongly radioactive, a result due to the presence of thorium X.

Attempts were also made to prove the presence of a new element by electrolytic methods, which did not lead to the separation of an



element of constant radioactivity, but indicated that solutions of thorium from thorianite and other minerals behave on electrolysis like dilute solutions of a new element which is strongly radioactive.

A. McK.

### Ionic Sizes in Relation to the Conductivity of Electrolytes.

WILLIAM R. BOUSFIELD (*Proc. Roy. Soc.*, 1905, 74, 563—564).—Starting with the hypothesis that the ions of an electrolyte consist of molecular aggregates largely composed of water molecules, the size of an ion depending on the amount of combined water and being a function of temperature and concentration, the author deduces the following expression for the true coefficient of ionisation in the case of potassium chloride,  $\alpha = \Lambda/\Lambda_{\infty} \cdot 1/f \cdot 1/(1 + 3 \cdot 33h^{-\frac{2}{3}})$ , where  $f$  is the fluidity of the solution and  $h$  is the "hydration," that is, the ratio of the molecules of water present to the molecules of the solvent. With this coefficient of ionisation, van't Hoff's dilution law, modified by substituting the "hydration" of the solute for its concentration, gives accurate agreement with experimental results over a wide range.

The water entering into combination with the ion is probably abstracted from the solvent largely as "trihydrol" or "hydrol," according to the temperature, and enters into combination with the ion as "dihydrol," thus causing contraction. The ionic volumes calculated from the conductivities on the above hypothesis are in agreement with the solution volumes calculated from the densities. For isothermal concentration changes, the ionic volume decreases as the solution volume increases, that is, with increasing water combination there is increasing contraction, a result which was to be anticipated. But in the case of temperature changes at constant concentration there is increasing water combination with diminishing contraction. This result, however, may be explained by reference to the variation with temperature of the proportions of trihydrol and dihydrol. On the assumption that the attack of the ions on trihydrol and dihydrol is in proportion to their concentrations at the temperatures considered, the volume changes deduced from the conductivities are shown to agree with the volume changes deduced from the densities.

A new variety of viscosity apparatus is described, and measurements of the viscosities and densities of potassium chloride solutions from 0—21 per cent. concentration are recorded.

J. C. P.

Electroaffinity Differences between Valency Stages and their Oxidation Equilibria. II. Mutual Relationships of the Valency Stages of Thallium and the Oxidation Power of Oxygen. JAMES F. SPENCER and RICHARD ABEGG (*Zeit. anorg. Chem.*, 1905, 44, 379—407. Compare Abegg, this vol., ii, 155).—Potential measurements of solutions of thallous and thallic salts with platinum electrodes were made against a 1/10 *N* calomel electrode ( $\epsilon_A = -0 \cdot 336$  volt<sup>2</sup> at 25° by the compensation method. At first the same result could not be attained by the use of two different electrodes, although the result after some time was identical. Thallic salts tend to pass into thallous salts, according to the equation  $Tl''' \rightarrow Tl' = 1 \cdot 199 + 0 \cdot 029 \log Tl'''/Tl'$ .

The dilution of a mixture of thallous and thallic salts has, in the case of the sulphate and nitrate, no influence of the *E.M.F.*, that is, the ratio of the concentration of thallous to thallic salt is constant, and both stages are strongly ionised.

The tendency of an ion (*i*) to undergo transformation into another ion (*o*), exhibiting a valency *n* times less than the former, is expressed in volts by the equation  $\epsilon_i \rightarrow_o = P + 0.059/n \log i/o$ , where *P* is a constant expressing the tendency for the transition of the *i* into the *o* valency stage, where the concentrations of the ions are identical. For the transition of thallic into thallous chloride, this constant lies nearer the reduction end of the series of electromotive forces than for the nitrate and sulphate, and this is changed on dilution in the direction of the greater tendency to oxidation.

The tendency of the thallic ion to form complexes with the following anions increases in the sequence, Cl', tartrate, acetate, CNO', (CO<sub>2</sub>)<sub>2</sub>", Br', NO<sub>2</sub>', I', CNS', SO<sub>3</sub>", CN', S<sub>2</sub>O<sub>3</sub>".

The hydrolytic reaction,  $\text{Ti}(\text{NO}_3)_3 + 3\text{H}_2\text{O} = \text{Ti}(\text{OH})_3 + 3\text{HNO}_3$ , is reversible, and gives the constant for the law of mass action,

$$(\text{HNO}_3)^3/\text{Ti}(\text{NO}_3)_3 = 13.6.$$

The solubility product for thallic hydroxide is  $L = 10^{-52.83}$ .

The solubility of thallic hydroxide is  $10^{-13.52}$  molar.

Oxygen oxidises thallous nitrate to the extent of about 2 per cent. until equilibrium is attained, platinum being the catalyst.

The oxidation potential of oxygen is  $1.1385 \pm 0.001$  volt.

Thallic and thallous salts are in equilibrium with thallium, when the ratio of the concentrations  $\text{Ti}^{III}/\text{Ti}$  is  $10^{-52.2}$ .

A résumé of the potentials measured is quoted.

A. McK.

**Electromotive Force between Metals and Solutions of their Salts in Water and Methyl Alcohol.** GIACOMO CARRARA and L. D'AGOSTINI (*Gazzetta*, 1905, 35, i, 132—144).—The authors have measured, by Poggendorff's method, the *E.M.F.* of a number of elements of the type  $\text{Hg} - \text{HgCl} - n\text{KCl} - n\text{KNO}_3 - \text{AgNO}_3 - \text{Ag}$ , using the metals copper, silver, cadmium, and zinc, and from the results obtained have calculated the absolute potentials between the metals and their salt solutions, and also the solution tensions of the metals. In methyl alcohol, the potential differences between the metals and their solutions are, if they are positive, smaller than, and, if they are negative, greater than, the corresponding values for aqueous solutions. Assuming that the electrolytic pressure of solutions of metals is independent of the solvent, it follows that the organic solvent gives solutions of electrolytes in which the osmotic pressure of the metallic ions is smaller than that of the corresponding aqueous solutions. The difference must, to a great extent, be attributed to the less dissociation of the substance dissolved in the solvent with a less ionising power, and, indeed, the contact potentials of the methyl alcohol solutions tend, in some measure, to approximate to those of aqueous solutions as the dilution is increased. The tensions of the metals in the two solvents are in the same order, but their absolute values are very different in the two cases; the ratio between the values in aqueous

and methyl-alcoholic solution is 1.3 for zinc, 2.2 for cadmium, 0.85 for copper, and 1 for silver.

For cadmium nitrate in methyl-alcoholic solution, the potential differences are small, whilst measurements of the elevation of boiling point show that this salt has a degree of dissociation in methyl alcohol of the same order of magnitude as in water. The electrolytic solution pressure must hence vary with the solvent. The authors explain this by supposing that the electro-striction, and therefore the alteration of the solvent by the ions, is different in different solvents. T. H. P.

**Dissociation of Ternary Electrolytes.** KARL DRUCKER (*Zeit. Elektrochem.*, 1905, 11, 211—215).—The determination of the concentration of a single ion in the solution of a ternary salt by means of an isohydric solution of a suitable binary salt (Kümmel, this vol., ii, 226) is only applicable when no complex ions are formed from the binary and ternary salts. It also assumes that the law of mass action applies to the solutions used. The author prefers a method which he described some years ago (*Abstr.*, 1902, ii, 3). By means of it, he calculates the concentration of the single ion  $B$  in solutions of salts of the type  $AB_2$ , and compares the numbers so obtained with those calculated from the electrical conductivity on the assumption that only the simple ions  $A$  and  $B$  are formed. The result is that when the transference numbers are independent of the concentration the agreement is good, which would indicate that the assumption of simple dissociation is warranted, whereas in cases in which the transference number changes with the concentration, the agreement is bad, especially in stronger solutions, which would point to the formation of complex ions. T. E.

**Dissociation of Cadmium Iodide.** JAMES W. MCBAIN (*Zeit. Elektrochem.*, 1905, 11, 215—223).—A compilation of results of previous observers relating to the electrical conductivity, freezing point, and transference numbers of solutions of cadmium iodide, from which it is shown that very dilute solutions of this salt contain the ions  $Cd^{++}$  and  $I^-$ , whereas very concentrated solutions contain  $Cd^{++}$  and  $CdI_3^-$ . The details of the calculations cannot be abstracted briefly. T. E.

**Diamagnetism of Bismuth.** ANATOLE LEDUC (*Compt. rend.*, 1905, 140, 1022—1023).—Although bismuth forms cubic crystals belonging to the regular system, there are reasons for supposing that a sphere cut from a crystal of the metal would take up a definite orientation when brought into a magnetic field. The question has been subjected to experiment in the following way. Small spherical glass bulbs of 2 cm. diameter were filled with molten bismuth, and the metal allowed to solidify whilst the bulbs were under the influence of a strong magnetic field. If the crystalline spheres of bismuth are then suspended freely in the same magnetic field, they take up the same orientation as that which they had at the moment of solidification of the metal. If the magnetic field is cut off and the bulbs are made



to rotate about the axis of suspension, the motion is at once stopped when the magnetic field is established, and the bulbs are found to be orientated as at the time of crystallisation.

H. M. D.

**Comparison of the Platinum Scale of Temperature with the Normal Scale at Temperatures between  $444^{\circ}$  and  $-190^{\circ}$ , with Notes on Constant Temperatures below the Melting Point of Ice.** MORRIS W. TRAVERS and ALFRED G. C. GWYER (*Proc. Roy. Soc.*, 1905, 528—538).—The authors have compared the platinum and hydrogen thermometers at  $-190^{\circ}$  (liquid air),  $-78.2^{\circ}$  (solid carbon dioxide and alcohol), and  $32.38^{\circ}$  (transition temperature of sodium sulphate). For points between  $30^{\circ}$  and  $-190^{\circ}$ , Callendar and Griffiths' parabolic formula may be used to calculate the difference ( $\Delta$ ) between the platinum scale of temperature and the scale of the gas thermometer,  $\delta$  being taken as 1.90; the maximum error in the calculation of  $\Delta$  is then probably not greater than  $0.2^{\circ}$  at about  $-100^{\circ}$ , but the formula cannot be employed except for interpolation. A standard scale of temperature, based on Callendar's three fixed points, would, supposing standard wire to be used and  $\delta$  taken = 1.5, lead to absurd results at low temperatures, and the converse may be said of the authors' observations.

J. C. P.

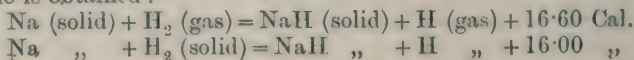
**Dependence of Free Energy on Temperature.** JOSEPH E. TREVOR (*J. Physical Chem.*, 1905, 9, 299—310).—A mathematical paper dealing chiefly with a hypothesis of Richards in a paper on atomic volumes (*Abstr.*, 1903, ii, 132). This hypothesis, as stated by Richards, is that "the change of free energy with temperature has a fundamental connection with the change of total energy with temperature," the connection being expressed  $d\Delta f/d\theta = -M.d\Delta e/d\theta$ . The author shows that this is equivalent to the hypothesis that isothermal changes of specific heat are proportional to the  $1/M$ th power of the temperature, that is,  $\Delta c_2 = A.\theta^{1/M}$ . The principles of thermodynamics, however, do not appear to bear upon the possibility of this relationship.

L. M. J.

**Heat of Vaporisation of Liquefied Gases.** EMILE MATHIAS (*Compt. rend.*, 1905, 140, 1174—1176. Compare *Abstr.*, 1888, 773).—A theoretical paper.

M. A. W.

**Heat of Formation of Sodium Hydride; Acidity of the Hydrogen Molecule.** ROBERT DE FORCRAND (*Compt. rend.*, 1905, 140, 990—992. Compare *Abstr.*, 1900, ii, 528).—Sodium hydride was prepared by heating the metal in pure hydrogen at  $375-380^{\circ}$ . The heat of solution of the hydride in water, measured with quantities varying from 7 to 38 mg., was found equal to 25.80 Cal. (mean of four experiments). Combining this result with the heat of solution of metallic sodium in water (42.40 Cal.), the heat of formation of sodium hydride is obtained:



The latter number represents the value of the acidity of the molecule of solid hydrogen.

The coefficient of acidity of the atom of hydrogen has been previously given (*loc. cit.*) as 18.43 Cal. The difference between 18.43 and 16.00 is supposed by the author to be due to the influence exerted by the second atom of hydrogen on the neutralisation of the first by sodium. The acidity of the first atom is on this account diminished, and the heat disengagement is smaller.

H. M. D.

**An Empirical Relationship between the Densities of Two Liquids.** K. SCHAPOSCHNIKOFF (*Zeit. physikal. Chem.*, 1905, 51, 542—546).—If  $d_T$  and  $d_{T'}$  are the densities of two liquids under the pressure of their own vapour at two temperatures  $T$  and  $T'$ , such that  $T - T' = T_K - T'_K$  ( $T_K$  and  $T'_K$  being the respective critical temperatures), then the relation between the densities is given by the equation  $d_T = n.d_{T'} + b$ , where  $n$  and  $b$  are constants for each pair of substances. With the help of already available data, the formula is tested and found satisfactory for the following pairs of liquids: (1) benzene and stannic chloride; (2) heptane and fluorobenzene; (3) pentane and heptane; (4) pentane and ethyl alcohol; (5) pentane and carbon dioxide. The same formula is applicable to the densities of the saturated vapours as shown in the two cases: (1) pentane and carbon dioxide; (2) pentane and heptane. The densities of liquids under the pressure of their own vapour and the densities of saturated vapours are purely functions of the temperature; that is,  $d = f(T)$ . Combining this with the empirical relationship given above, the author deduces the equation  $(d' + a)/(d_K + a) = \phi[(T' + c)/(T_K + c)]$ , in which the function  $\phi$  is the same for all substances. This is a generalised form of van der Waals' equation.

J. C. P.

**Determination of Volume Change on Liquefaction.** A. HESS (*Chem. Centr.*, 1905, i, 1071; from *Physikal. Zeit.*, 6, 186—188).—The substance under investigation is placed in a beaker which is suspended by means of a Jolly spring balance in an electrically-heated thermostat, arranged in such a manner that convection currents are avoided. Thermocouples immersed in the beaker and in the surrounding bath indicate the temperature. The readings of the balance, as the temperature changes, are continuously recorded by means of a mirror rotating about a vertical axis. The liquid in the thermostat must be freed from dissolved gases, and the substance, which should almost fill the beaker, must be sufficiently small to ensure homogeneity and uniformity of temper. For solid, yellow phosphorus at its melting point (44.5°), the specific volume 0.55399 was obtained; for the liquid at the same temperature, 0.057305. The increase in volume on liquefaction is 3.44 per cent.

H. M. D.

**Compressibility of Gases between One Atmosphere and Half an Atmosphere of Pressure.** LORD RAYLEIGH (*Phil. Trans.*, 1905, A 204, 351—372. Compare Abstr., 1901, ii, 542).—Details are given of the methods used in the work already described (Abstr., 1904, ii, 313), and some fresh results are recorded. The correction

factors at about  $13^{\circ}$  (see *loc. cit.*) for carbon dioxide and nitrous oxide are 0.99518 and 0.99422 respectively. For ammonia at about  $10^{\circ}$  the ratio of *pv.* at 0.5 atmosphere to the corresponding value at 1.0 atmosphere is 1.00632.

J. C. P.

**Fundamental Functions of One-component Ideal-constituent Gases.** JAMES M. BELL and JOSEPH E. TREVOR (*J. Physical Chem.*, 1905, 9, 179—209).—A mathematical paper in which the authors first recapitulate the Gibbsian theory as applied to dissociation equilibrium between unimolecular and bimolecular gaseous forms of a one-component substance. The authors extend the Gibbsian equation and derive characteristic equations for the pressure, molecular volume, the thermodynamic potential and free energy and their derived functions. A large number of equations are deduced, from which the following may be noted. The increase of dissociation per degree at constant pressure is proportional to  $Qp/\theta^2$  where  $Qp$  is the molecular heat of dissociation at constant pressure and  $\theta$  is the absolute temperature. A similar proportionality obtained also at constant volume. The heat capacity at constant pressure or volume is investigated and the work and heat integrals for isothermal paths or paths of constant dissociation are determined. These allow of comparison with the experimental results of Berthelot and Ogier for the heat of cooling of given masses of nitrogen peroxide. The agreement is quite satisfactory.

L. M. J.

**Abstract and Concrete Conceptions (Osmotic Pressure and Thermodynamic Potential).** JOHANNES J. VAN LAAR (*Chem. Centr.*, 1905, i, 1067; from *Chem. Weekblad*, 2, 143—156. Compare this vol., ii, 234).—Mainly polemical. The agreement of the osmotic pressure with the simple gas laws is only apparent. The equations for the osmotic pressure,  $\pi = RT[c + (\frac{1}{2} - a)c^2]$ , and for the pressure of a gas,  $p = RT(c - \lambda c^2)$ , are quite different except when the limiting condition  $c = 0$  (infinite dilution) is reached.

In the theoretical treatment of chemical systems, the employment of osmotic pressure instead of thermodynamic potential on account of the abstract nature of the latter conception is unjustifiable. Other conceptions in general use are equally abstract. A comparison is made between thermodynamic potential and electric potential. Both determine an internal condition which is only recognisable by its consequences. Osmotic pressure, lowering of freezing point, and lowering of vapour pressure are secondary consequences of a condition determined primarily by the thermodynamic potential.

H. M. D.

**Influence of One Substance on the Solubility of Another Substance.** FRIEDRICH HOFFMANN and K. LANGBECK (*Zeit. physikal. Chem.*, 1905, 51, 385—434).—The authors have determined the solubilities of benzoic, salicylic, and *o*-nitrobenzoic acids as these are affected by various electrolytes and non-electrolytes.

At  $25^{\circ}$ , dextrose is practically without effect on the solubility of benzoic acid, but at  $45^{\circ}$  the solubility of the acid increases slightly as



the dextrose concentration increases. In solutions of sodium and potassium chlorides and nitrates, benzoic acid becomes less soluble as the salt concentration increases, and the effect of the salts is more marked at  $45^\circ$  than at  $25^\circ$ . The relative influence of the various salts is in accordance with Rothmund's rules (Abstr., 1900, ii, 467).

The solubility of salicylic acid in dextrose solutions increases regularly with the concentration of the latter, and the increase at  $35^\circ$  is the same as at  $25^\circ$ . Ethyl and isobutyl alcohols, especially the latter, raise the solubility of salicylic acid to a marked extent, and the increase in both cases is more marked at  $35^\circ$  than at  $25^\circ$ . With the electrolytes, on the other hand, the solubility of salicylic acid is first raised and then lowered as the salt concentration increases—a peculiar characteristic that is still more definite in the case of the stronger *o*-nitrobenzoic acid. When the percentage change of solubility of the acid is plotted against the salt concentration, maxima are observed for each curve, and the curve for  $35^\circ$  invariably lies below the curve for  $25^\circ$ . Dextrose lowers the solubility of *o*-nitrobenzoic acid, the percentage diminution being approximately proportional to the dextrose concentration; the temperature-coefficient, however, for dextrose is the opposite of that for the electrolytes.

On the basis of Jahn's theory (Abstr., 1902, ii, 597), formulæ are established from which the solubilities of the three acids in the various solutions can be calculated from the solubilities in pure water. The agreement between the calculated and the observed values is very good for the non-electrolytic solutions, but is incomplete in the other case, owing probably to insufficient data regarding the dissociation of the electrolytes involved.

The solubilities of the acids in water are as follows, the numbers indicating grams of acid per 1000 grams of saturated solution: benzoic acid, 3.4009 at  $25^\circ$ , 6.6702 at  $45^\circ$ ; salicylic acid, 2.2062 at  $25^\circ$ , 3.197 at  $35^\circ$ ; *o*-nitrobenzoic acid, 7.3156 at  $25^\circ$ , 10.537 at  $35^\circ$ . J. C. P.

#### Solubility and Dissociation of Double Salts in Water.

IV and V. EBERHARD RIMBACH and A. GREWE (*Ber.*, 1905, 38, 1553—1564, 1564—1572. Compare Abstr., 1898, ii, 158; 1902, ii, 306; 1904, ii, 264).—The double salt,  $\text{CdBr}_2 \cdot \text{KBr} \cdot \text{H}_2\text{O}$  ( $\frac{1}{2}\text{H}_2\text{O}$ ; Hauer, *Wien. Akad. Ber.*, 15, 23), forms rhombic prisms [ $a:b:c = 0.4592:1:1$ ]; the solubility determinations give values agreeing with  $P(112.5^\circ/0.4^\circ) = 55.108 + 0.218t$ , and show that the salt is not decomposed by water within that interval of temperature. Contrary to Eder's (*Dingler's Journ.*, 1876, 189) and Tassilly's statement (Abstr., 1899, ii, 747), the double salt,  $\text{CdBr}_2 \cdot \text{NH}_4\text{Br}$ , is anhydrous; it is not dissociated on solution in water at  $1-110.1^\circ$ , and has the solubility  $P(110^\circ/1^\circ) = 54.47 + 0.197t$ .

The double salt,  $\text{CdBr}_2 \cdot \text{RbBr}$ , forms anhydrous crystals and has  $P(107^\circ/0^\circ) = 35.34 + 0.393t$ .

Solubility determinations with rubidium bromide give the value  $P(114^\circ/0.5^\circ) = 48.63 + 0.1751t$ . The following values were calculated from solubility determinations by other authors: for  $\text{KBr}$ ,  $P(100^\circ/0^\circ) = 36.192 + 0.1543t$ ; for  $\text{NH}_4\text{Br}$ ,  $P(100^\circ/10^\circ) = 38.958 + 0.1768t$ ; for  $\text{CdBr}_2$ ,  $P(100^\circ/36^\circ) = 59.583 + 0.0183t$ ;  $(36^\circ/0^\circ) = 37.803 + 0.6319t$ .

These results agree with the rule that the value  $dP/dt$  is greater for double salts than for their constituents.

The double salt,  $\text{CdBr}_2 \cdot 4\text{NH}_4\text{Br}$ , formed from a solution of its components containing excess of cadmium bromide, separates in hexagonal plates [ $a:c=1:0.6269$ ]; when shaken with water at from  $0.8^\circ$  to  $123.5^\circ$ , it partly decomposes, the solution containing an excess of cadmium bromide, the solid, the unchanged salt and ammonium bromide; the transformation point is passed by  $160^\circ$ .

The double salt,  $\text{CdBr}_2 \cdot 4\text{KBr}$  (Eder, *loc. cit.*; Hauer, *loc. cit.*), cannot be formed from a solution of its components at temperatures up to  $160^\circ$ .

The double salt,  $\text{CdBr}_2 \cdot 4\text{RbBr}$ , crystallises in hexagonal plates [ $a:c=1:0.6231$ ]; the salt is isomorphous with the corresponding ammonium salt; the solubility determinations give the value  $P(115^\circ/0^\circ)=50.88+0.2637t$ .

With alkali iodides, cadmium iodide forms the two series of salts,  $\text{CdI}_2 \cdot \text{M'I}$  and  $\text{CdI}_2 \cdot 2\text{M'I} \cdot 2\text{H}_2\text{O}$ ; the latter forms large, transparent, hygroscopic crystals.

It has been shown that double salts which, when shaken with water, form incongruent saturated solutions containing an excess of one component are not decomposed by a solution of that component. It is now found that the excess of the one component necessary to form the double salt may be replaced by other substances having the same anion. Thus the dissociation of  $\text{CdCl}_2 \cdot 4\text{KCl}$  by water is diminished by the presence of hydrochloric acid or lithium, calcium or magnesium chloride, and when these salts are present in certain concentrations no dissociation of the double salt takes place; the effective molecular percentage concentration at  $16^\circ$  for  $\text{CaCl}_2$  is 0.1887, for  $\text{LiCl}$  0.4483, for  $\text{HCl}$  0.8828. Similarly with the double salt,  $\text{CdCl}_2 \cdot 4\text{RbCl}$ , the incongruent saturated solution of which contains an excess of 12.83 mols. of  $\text{RbCl}$  over each mol.  $\text{CdCl}_2 \cdot 4\text{RbCl}$ , the minimum effective molecular percentage concentration for  $\text{CaCl}_2$  is over 4.59, for  $\text{LiCl}$  over 19.4, for  $\text{HCl}$  over 29.8.

The double salt,  $\text{CdCl}_2 \cdot 4\text{NH}_4\text{Cl}$ , is obtained from solutions of its components containing hydrochloric acid, lithium, calcium, or magnesium chloride. The dissociation of the double salt,  $\text{CdBr}_2 \cdot 4\text{NH}_4\text{Br}$ , which forms a saturated solution containing an excess of cadmium bromide, is not affected by the presence of hydrobromic acid or lithium, calcium, magnesium, nickel, or cobalt bromides, but the pure double salt is obtained by mixing solutions of its components and zinc bromide. The double salt,  $\text{UO}_2 \cdot \text{SO}_4 \cdot 2\text{K}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ , is completely dissociated on recrystallisation from dilute sulphuric acid, the solution depositing  $\text{UO}_2\text{SO}_4 \cdot \text{K}_2\text{SO}_4$ .

G. Y.

#### Mixed Crystals in Systems of Three Substances. II. FRANS

A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1905, 51, 547—576. Compare this vol., ii, 154).—A theoretical paper.

J. C. P.

**A Rule in Chemical Dynamics.** JOH. PLOTNIKOFF (*Zeit. physikal. Chem.*, 1905, 51, 603—608).—The curves obtained by plotting reaction velocity-coefficients against temperature are similar to those representing the course of the reaction. The latter are logarithmic curves,

and similarity between the two sets of curves would mean that the change of the velocity-coefficient with temperature is proportional to the velocity-coefficient itself: that is,  $dk/dt = ak$ . The integration of this leads to  $a = (\log k_1 - \log k_2)/(t_1 - t_2)$ , a formula which is tested with satisfactory results in some thirty cases. Since the equilibrium constant is the quotient of two velocity-coefficients, an analogous formula may be deduced for the equilibrium constant, namely,  $\beta = (\log K_1 - \log K_2)/(t_1 - t_2)$ . The applicability of the latter formula is tested in a few cases with satisfactory results.

J. C. P.

**Equilibrium between a Nitrogen Base and Organic Acids in Various Solvents.** HERBERT F. SILL (*Zeit. physikal. Chem.*, 1905, 51, 577—602).—The equilibrium constant  $k_e$  for the reaction (cinchonine salt)  $\rightleftharpoons$  (cinchonine cation) + (acid anion) and the equilibrium constant  $k_a$  for the reaction (cinchonine salt)  $\rightleftharpoons$  (free cinchonine) + (free acid) have both been determined for a series of organic acids (benzoic, *p*-hydroxybenzoic, and butyric acids, trichlorophenol, *o*- and *p*-nitrophenol) in methyl- and ethyl-alcoholic solution. The total base (free and combined) in solution was determined by titration, and as the solutions were kept saturated with cinchonine the amount of free base was known. The molecular conductivity of the solutions was determined, and  $\lambda_\infty$  was calculated from the corresponding value for water (see Völlmer, *Abstr.*, 1894, ii, 339); thus the degree of dissociation of the cinchonine salt could be ascertained. The values obtained for  $k_e$  in each case are satisfactorily constant, that is, Ostwald's dilution law is fulfilled in the case of these cinchonine salts, although it should be noted that the author's experiments do not cover a wide range of concentration. The values of  $k_a$  for different concentrations are also satisfactorily constant. The affinity constants of the various acids in alcoholic solution are proportional to the product  $k_a k_e$ , and run approximately parallel to the affinity constants of the same acids in water; *p*-nitrophenol, however, is a marked exception to this rule, a fact in harmony with Hantzsch's view that this substance is a pseudo-acid (see *Abstr.*, 1900, i, 94). The value of  $k_e$  for the methyl-alcoholic solutions stands in a constant ratio to the corresponding value for the ethyl-alcoholic solutions, to which rule *p*-nitrophenol is again an exception.

For a given solvent, the values of  $k_e$  vary but slightly with the acid used, so that the value of  $k_a$  alone is really a measure of the strength of the acid. This is confirmed not only for the methyl- and ethyl-alcoholic solutions, but also for some solutions in *isoamyl* alcohol and acetone.

J. C. P.

**Reaction-velocities in Heterogeneous Systems: with Particular Reference to Enzyme Actions.** GEORGE SENTER (*J. Physical Chem.*, 1905, 9, 311—320).—The view has been put forward by Nernst that at the surface of separation of two phases, equilibrium is very rapidly established, and that what is actually measured as the rate of reaction is, in reality, the rate of subsequent diffusion (*Abstr.*, 1904, ii, 315). Consequently doubts were cast on the van't Hoff method of determining the order of a reaction. The results of Brunner



(*ibid.*) in the case of velocities of dissolution were in agreement with these views, whilst experiments of Heber (Abstr., 1904, ii, 309) showed that, although in some cases electrical reduction proceeds with measurable velocity towards equilibrium, yet in other cases diffusion velocities are obtained. It is probable, therefore, that the relative parts played by diffusion and the actual chemical change must be determined in each particular case. The author suggests the three following criteria: (1) relation between diffusive power and reaction-velocity; (2) effects of substances which alter viscosity; (3) temperature-coefficient; and applies these in an investigation on the velocity of enzyme reactions, based on the results of previous observers. Although the data are insufficient for definite conclusions, they tend to show that in these cases the velocities are true reaction-velocities, and that the formula and theory suggested by Herzog are not valid (Abstr., 1904, ii, 506).

L. M. J.

**Enzymatic Fermentation from the Point of View of Chemical Dynamics.** HANS EULER (*Zeit. physiol. Chem.*, 1905, 44, 53—73. Compare Aberson, Abstr., 1903, ii, 445; Herzog, *ibid.*, ii, 230).—The enzyme used was zymase, prepared by Büchner's method from a bottom yeast, rendered poor in glycogen by drying for 3—4 hours at 40° in thin layers. The yeast extract, which was only very slightly optically active, was mixed with solutions of pure dextrose and 0.2 c.c. of toluene and the amounts of carbon dioxide evolved after given times determined gravimetrically or gasometrically.

The results have been used for calculating the velocity constant,  $K = 1/\log a/a - x$ , where  $a$  = the amount of carbon dioxide in grams or c.c. evolved during time  $t$ , and  $a - x$  the amount of carbon dioxide which would be evolved supposing the whole of the remaining dextrose became transformed into alcohol and carbon dioxide. The value for  $K$  is fairly constant for any set of experiments, but shows a tendency to diminish as  $t$  increases.

The results of numerous experiments show:

(1) That the constant becomes smaller when the concentration of the original sugar solution is increased, but the relationship is not one of inverse proportionality.

(2) That the velocity is not directly proportional to the zymase concentration, but increases more quickly. The exponent  $n$  in the equation  $n = (\log K_1 - \log K_2)/(\log c_1 - \log c_2)$  becomes smaller and approximates closer to 1 as the concentration of the zymase is increased.

(3) That when the amount of extract and of sugar are kept constant and the amount of water varied, the constant is almost directly proportional to the concentration.

J. J. S.

**Chemical Combination.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 140, 1153—1159. Compare this vol., ii, 308).—Nitrogen and hydrogen do not combine to form ammonia when heated in sealed silica tubes at 1300° for an hour and cooled either rapidly or gradually, and similarly negative results are obtained when the gases are heated in the presence of hydrogen chloride at temperatures above

800°; both the hydrogen and nitrogen escape by diffusion through the walls of the tube, the hydrogen more rapidly than the nitrogen, but the hydrogen chloride does not begin to diffuse until a temperature of 1400—1500° is reached. Ammonia is completely dissociated into hydrogen and nitrogen when heated at 1300°; at 600° 5.5 per cent., and at 800° 10 per cent. of the gas is dissociated; ammonium chloride is dissociated into hydrogen, nitrogen, and hydrogen chloride at 1300°, the hydrogen chloride undergoing no dissociation even at 1400—1500°. When hydrogen sulphide is heated at 1300° in sealed silica tubes and cooled gradually, the contents of the tube are completely absorbed by a solution of potassium hydroxide, but if the tube be cooled rapidly about 5 per cent. of the residual gas consists of hydrogen, showing that hydrogen sulphide is dissociated at a high temperature. M. A. W.

**Anti-oxidation of Solutions of Sodium Sulphite and Anti-oxidising Agents.** AUGUSTE LUMIÈRE, LOUIS LUMIÈRE, and ALPHONSE SEYEWETZ (*Bull. Soc. chim.*, 1905, [iii], 33, 444—454).—Anti-oxidation is the term applied to the phenomenon of the retardation of the rate of oxidation of aqueous solutions of sodium sulphite by air, induced by the addition of minute quantities of reducing (anti-oxidising) agents. The following substances are arranged in order of decreasing activity: quinol, *p*-aminophenol hydrochloride, glycine, *p*-phenylenediamine, catechol, "metol," "metoquinone," diaminophenol hydrochloride, "adurol," "edinel," and "eikonogen." Acetone behaves in the reverse way. The effect is independent of time, temperature, light, and the concentration both of the sulphite and the anti-oxidising agent, but is diminished by the addition of alkaline substances, acetone or formaldehyde. The action appears to be catalytic in character. It is pointed out that a solution of sodium sulphite may be preserved for a prolonged period by the addition of a small quantity of one of the more active anti-oxidising agents.

T. A. H.

**Contact Phenomena in the Flame under the Influence of Solids.** A. A. BAIKOFF (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 156—169).—The author finds that solid substances, such as platinum, quartz, and porcelain, when heated in one and the same flame, assume various temperatures differing from the temperature of the flame itself; the difference may amount to several hundreds of degrees. The temperature to which a solid becomes heated in a flame depends on the contact properties of the solid and on the relation between its surface and its volume. The method of determining the temperature of a flame by the temperature to which a solid body is heated in it is hence quite inaccurate, and the true temperature of a flame is at present an unknown quantity. The differences in the luminosities of different solids when heated in one and the same flame are dependent on the fact that the substances assume different temperatures.

T. H. P.

**Rôle of Diffusion in the Catalysis of Hydrogen Peroxide by Colloidal Platinum.** GEORGE SENTER (*Proc. Roy. Soc.*, 1905, 74, 566—574).—A discussion of the points raised by Sand (this vol., ii,

233). The deviations from the simple logarithmic formula in the catalytic decomposition of hydrogen peroxide by colloidal platinum are probably due to disturbances caused by convection currents. It is also shown that when the velocity constant, calculated on Nernst's diffusion hypothesis, is great compared with the chemical velocity constant, increased convection can produce no appreciable effect on the observed reaction-velocity. Since, in the case under consideration, increased convection does modify the observed reaction-velocity, there must be some error in the assumptions leading to the conclusion that the diffusion velocity constant is great compared with the chemical velocity constant. The error probably lies in the assumption that the whole platinum surface is, under ordinary conditions, active towards hydrogen peroxide.

The considerations which favour Nernst's diffusion hypothesis as applied to the platinum catalysis are the small value of the temperature-coefficient and the fact that the deviations from the simple logarithmic law in catalysis by platinum have their exact analogy in the hæmase catalysis.

J. C. P.

**Isodimorphism.** FRÉDÉRIC WALLERANT (*Compt. rend.*, 1905, 140, 1045—1046).—Thallous nitrate and ammonium nitrate are both polymorphous, the former crystallising in cubic, rhombohedral, or orthorhombic forms, whilst the latter forms cubic, quadratic, or orthorhombic crystals. The mixed crystals which separate on cooling fused mixtures of the two nitrates have been examined. If the percentage of ammonium nitrate in the fused mass does not exceed 3·2, the mixed crystals which separate resemble thallous nitrate, and assume successively cubic, rhombohedral, and orthorhombic forms on cooling. If the percentage of ammonium nitrate in the fused mass lies between 3·2 and 5·8, then on solidification there seem to be formed two varieties of cubic crystals, one form containing 3·2 per cent., the other 5·8 per cent. of ammonium nitrate. On cooling to 104°, the cubic crystals of the first kind become rhombohedral, whilst those of the second kind are transformed into quadratic crystals. On further cooling, the rhombohedral crystals become orthorhombic at 68°. When the proportion of ammonium nitrate in the fused mixture exceeds 5·8 per cent., the cubic crystals which first separate are transformed into quadratic crystals, but as the proportion of ammonium nitrate increases these are transformed into crystals belonging to the orthorhombic system. Three series of mixed crystals are thus obtained at the ordinary temperature.

H. M. D.

**The Eighth Group of the Periodic System.** RICHARD ABEERG (*Ber.*, 1905, 38, 1386—1388. Compare Werner, this vol., ii, 308).—Helium, neon, argon, krypton, and xenon, and iron, cobalt, nickel, and the platinum metals are arranged respectively as sub-groups in the eighth group of the periodic system; it is pointed out that from theoretical considerations the two sub-groups of this group must differ greatly from one another, just as the sodium metals differ from copper, silver, and gold. Further, the inert elements of the argon group form a link between the strongly electronegative elements of the seventh



and the electropositive elements of the first groups: the existence of such a group was forecast by Lothar Meyer. E. F. A.

**Lecture Experiments [Decomposition of Carbon Dioxide by Magnesium].** KARL BRUNNER (*Ber.*, 1905, 38, 1432).—Magnesium powder is scattered over a flat dish containing solid carbon dioxide, a small amount of burning magnesium is dropped into this; the metal continues to burn and forms a grey cake, which, on treatment with water and hydrochloric acid, leaves a residue of black, flocculent carbon. Aluminium powder burns under the same conditions, some aluminium carbide and oxide being formed. J. J. S.

**Quantity of Moisture left in a Gas after its Passage over Phosphoric Oxide.** EDWARD W. MORLEY (*J. Chim. Phys.*, 1905, 3, 241—244).—The total quantity of moisture and phosphoric oxide vapour left in 4300 litres of gas dried by the dehydrator was only 0.1 mg.; further experiments to determine the quantities of each, indicated that the whole was phosphoric oxide, but the author does not consider them trustworthy owing to the magnitude of the relative errors. His results show, however, that for any gravimetric work the moisture contained in a gas dried by this dehydrator is quite negligible. L. M. J.

**New Filter Tube.** H. P. MASON (*Chem. News*, 1905, 91, 180—181).—In this arrangement, the stem is separate from the body of the tube, and is shaped to remain in position at the constricted lower end of the tube body, and to form a ledge upon which a porcelain disc for supporting the filtering material can rest. The stem is slightly longer than the body, and can be used to eject the filter. D. A. L.

## Inorganic Chemistry.

**Acceleration of the Evolution of Chlorine from Potassium Chlorate and Hydrochloric Acid by the presence of Platinum.** H. SIEK (*Zeit. Elektrochem.*, 1905, 11, 261—263).—Sand (this vol., ii, 156) has shown that the reaction between a chlorate and hydrochloric acid takes place slowly, and is represented by the equation  $\text{ClO}_3 + 2\text{H}^+ + 2\text{Cl}^- = \text{ClO} + 2\text{HOCl}$ . The hypochlorous acid and hydrochloric acid then react, rapidly producing chlorine. It is shown that this reaction is accelerated by platinum; the acceleration observed depends on the surface of platinum in contact with the solution. The acceleration of the reverse reaction is of importance in the electrolytic production of chlorates with platinum electrodes. T. E.

**Action of the Silent Electric Discharge on Chlorine.** FRANZ RUSS (*Ber.*, 1905, 38, 1310—1318. Compare Mellor, *Proc.*, 1904, 20, 140, 196).—The "activation" of chlorine, measured by its action on

benzene, is greatest when moist chlorine is exposed to the simultaneous action of light and of a silent electric discharge. The "activation" decreases as the chlorine is dried, and is much less if the action of light or of the silent discharge is omitted. As the action of light is due to the ultra-violet rays, the rate of "activation" is greater in a quartz than in a glass vessel. "Active" chlorine retains its activity for long periods at the ordinary temperature, but is rendered inactive by heating, by the passage of electric sparks, or by treatment with water.

G. Y.

**Apparatus to show the Production of Ozone during the Combustion of Coal Gas.** LÉON MAQUENNE (*Bull. Soc. chim.*, 1905, [iii], 33, 510—511).—A frame is used carrying four air-gas burners, producing flames from 15 to 20 mm. high. On the edges of each of these flames are placed two small horizontal tubes, and the whole eight tubes are connected to a central "blower." The current of air so produced blows away the ozone and nitrous fumes as soon as they are formed, and the presence of these gases can be detected by the usual tests at a distance of several metres from the apparatus.

T. A. H.

**Two Liquid States of Sulphur,  $S_\lambda$  and  $S_\mu$ , and their Transition Point.** ALEXANDER SMITH (*Proc. Roy. Soc. Edin.*, 1905, 25, 588—589).—It is shown that there are two liquid states of sulphur, which are only partially miscible; these are yellow, mobile sulphur ( $S_\lambda$ ), predominating from the melting point to  $160^\circ$ , and brown, viscous sulphur ( $S_\mu$ ), prevailing above  $160^\circ$ . The facts demonstrating the existence of these two states are, firstly, the sudden change of viscosity at  $160^\circ$  and the simultaneous marked absorption of heat. Further, it is shown that the curves of solubility of  $S_\lambda$  and  $S_\mu$  in triphenylmethane and other solvents are quite distinct, the solubility of  $S_\lambda$  increasing, that of  $S_\mu$  decreasing, with rise of temperature. The coefficient of expansion of  $S_\lambda$  diminishes rapidly from  $154^\circ$  to  $160^\circ$ , that of  $S_\mu$  increases rapidly from  $160^\circ$  upwards. The point of minimum dilatation is displaced upwards when triphenylmethane is dissolved in the sulphur. The dilatometric method gives no evidence of the existence of Frankenheim's transition point at  $250-260^\circ$ .

J. C. P.

**Nature of Amorphous Sulphur, and Influence of Foreign Substances on the Phenomena of Supercooling observed when Melted Sulphur is suddenly chilled.** ALEXANDER SMITH (*Proc. Roy. Soc. Edin.*, 1905, 25, 590—592. Compare Abstr., 1903, ii, 139, 284, also preceding abstract).—A study of the hardening of plastic sulphur shows that the whole of the amorphous sulphur present cannot be obtained in quasi-solid form because of partial reversion to the soluble form. The sulphur, however, precipitated in presence of concentrated acids yields 100 per cent. of insoluble sulphur. The amounts of insoluble sulphur obtained on chilling common sulphur from various temperatures vary from 4.2 per cent. at  $130^\circ$  to 34 per cent. at  $448^\circ$ . These amounts

are greatly reduced when the sulphur has been heated for a long time at  $448^{\circ}$ , or for a shorter time in a vacuum, or has been used immediately after recrystallisation, or has been washed with water before being heated; such treatment probably removes the trace of sulphuric acid acquired by the sulphur on exposure to air. To the substances previously mentioned (Abstr., 1903, ii, 139) as favouring the formation of insoluble sulphur, iodine should be added. Sulphur which gives the insoluble form on chilling has the same constitution near the boiling point as sulphur which does not give the insoluble form on chilling. This was deduced from the identity in boiling point under ordinary and reduced pressures, and from the identity of specific gravity. Solubility experiments between  $120^{\circ}$  and  $160^{\circ}$  show further that the constitution of the two kinds of sulphur just mentioned is the same also below the transition point  $160^{\circ}$ . The conclusion is reached that amorphous sulphur is supercooled  $S_{\mu}$  (see preceding abstract), and the part played by carbon dioxide, ammonia, hydrogen sulphide, sulphur dioxide, iodine, &c., in influencing the amount of insoluble sulphur produced by chilling is probably just a hindering or promoting of the supercooling.

J. C. P.

**Improved Hydrogen Sulphide Apparatus.** AUGUST SCHRIMPF (Zeit. anal. Chem., 1905, 44, 195).—A modified Kipp apparatus, in which the solid reagent is placed in the uppermost bulb and the acid is supplied from an independent elevated tubulated bottle by tubing which passes to the bottom of the lower bulb.

M. J. S.

**Solubility of Sulphur Dioxide in Water.** AUGUST HARPFF (Chem. Centr., 1905, i, 1208; from Chem. Zeitschr., 4, 136—137).—The strength of the liquor which runs from the ordinary Schröder tower and the percentage of sulphur dioxide contained in it may vary within very wide limits. These quantities depend on the concentration of the gas, its temperature ( $t$ ), and the quantity of water ( $h$ ) with which the gas comes in contact. If  $g$  = volume of the gas absorbed, then for 100 parts and at atmospheric pressure,  $g = (a.h.v.)/100$ .

From a gas containing 10 per cent. by volume of sulphur dioxide at  $10^{\circ}$ , 1.63 per cent. by weight is dissolved by a litre of water. When the pressure in the tower is increased to five atmospheres, 8.14 per cent. by weight is dissolved.

E. W. W.

**Explanation of the Action of Strong Sulphuric Acid on Metals.** CHARLES M. VAN DEVENTER (Chem. Centr., 1905, i, 992; from Chem. Weekblad, 2, 137—140).—When concentrated sulphuric acid acts on metals, it is probable that the initial action consists rather in the formation of oxide, sulphur dioxide, and water, than in the formation of sulphate and hydrogen. According to both theories, the acid acts as an oxidising agent, but no direct proof of the formation of hydrogen has been adduced. Dilute sulphuric acid acts on zinc, but not on copper, silver, or mercury, which are all readily attacked, however, by the concentrated acid. The analogy between the action of carbon or sulphur on concentrated sulphuric acid with that of these elements on nitric acid, and the decomposition of sulphuric acid at



high temperatures into oxygen, water, and sulphur dioxide, lend support to the oxide theory. E. W. W.

**Reduction of Tetrathionates to Sulphites by Arsenite and Stannite.** AUGUST GUTMANN (*Ber.*, 1905, 38, 1728—1734).—A solution of sodium arsenite in sodium hydroxide acts on sodium tetrathionate according to the equation  $\text{Na}_2\text{S}_4\text{O}_6 + 3\text{Na}_3\text{AsO}_3 + 2\text{NaOH} = 2\text{Na}_3\text{AsSO}_3 + \text{Na}_3\text{AsO}_4 + 2\text{Na}_2\text{SO}_3 + \text{H}_2\text{O}$ . Sodium monothioarsenate,  $\text{Na}_3\text{AsSO}_3 \cdot 12\text{H}_2\text{O}$  (*Abstr.*, 1897, ii, 257), is identified by heating its aqueous solution with acids, when sulphur separates and arsenious acid is formed. Sodium monothioarsenate is not formed in an aqueous solution of sodium hydroxide, sodium tetrathionate, and sodium arsenite until the solution is warmed. The amount of arsenate formed was estimated.

Sodium stannite reduces sodium tetrathionate in alkaline solution to sulphite, thiostannate and stannate being also formed. A. McK.

**Formation of Ammonia from its Elements.** FRITZ HABER and GABRIEL VAN OORDT (*Zeit. anorg. Chem.*, 1905, 44, 341—378).—The determination of the equilibrium between nitrogen, hydrogen, and ammonia at 1020° has been studied more accurately than in the preliminary communication by the same authors (this vol., ii, 159). The free energy of formation of ammonia was calculated; the percentage of ammonia in mixtures of ammonia, nitrogen, and hydrogen in equilibrium under a pressure of 1 atmosphere was, for the temperatures 27°, 327°, 627°, 927°, 1020° respectively, 98·51, 8·72, 0·21, 0·024, 0·012 respectively.

The reversible action,  $\text{Ca}_3\text{N}_2 + 3\text{H}_2 \rightleftharpoons 3\text{CaH}_2 + \text{N}_2$ , takes place at a red heat, whilst ammonia is also formed. Traces of ammonia are formed during the action of hydrogen on calcium nitride, but not by the action of nitrogen on calcium hydride. The range of temperature within which the intermediate formation of a calcium compound takes place lies too high to enable a convenient synthesis of ammonia to be attained by its aid.

Manganese can be transformed into a nitrogen compound, and then again obtained from the latter by reduction, by the alternate action of nitrogen and hydrogen. The use of manganese as a catalyser in the synthesis of ammonia is suggested.

Experiments to demonstrate the synthesis of ammonia are described. A. McK.

**Decomposition of Ammonia at High Temperatures.** ALFRED H. WHITE and WM. MELVILLE (*J. Amer. Chem. Soc.*, 1905, 27, 373—386).—The experiments described were undertaken in order to ascertain the influence of change of temperature on the decomposition of ammonia and the effect of diluting the ammonia with one of the products of its decomposition, and with other gases which are generally present in the manufacture of coal gas. The apparatus consisted essentially of a glass combustion tube, through the wide end of which a Le Chatelier pyrometer tube of glazed porcelain was inserted. The gas was passed through the annular space between the pyrometer and

the combustion tube, and its temperature was measured just as it was about to be withdrawn and cooled. In this apparatus, experiments were made at temperatures between  $450^{\circ}$  and  $730^{\circ}$  with pure ammonia and with ammonia diluted with hydrogen, nitrogen, carbon monoxide, and water vapour. The results are tabulated and are also plotted as curves.

It is shown that the temperature of initial decomposition of ammonia is about  $450^{\circ}$ . The proportion of ammonia decomposed does not appear to be affected by dilution with hydrogen or nitrogen so long as the time that each ammonia molecule remains in the tube is not changed; there is therefore no tendency for the nitrogen and hydrogen to recombine. The rate of decomposition is somewhat increased by the presence of carbon monoxide or water vapour. In the presence of carbon monoxide, a small quantity of cyanogen is produced, a larger amount being formed with the dry gases than in the presence of aqueous vapour, but the highest yield obtained in any experiment only amounted to about 4 per cent. of the ammonia decomposed. The decomposition seems to take place almost entirely on the impact of the ammonia molecules on the hot solid surface, a larger proportion being decomposed on a rough than on a smooth surface; thus it has been found that ammonia gas may undergo but slight decomposition when passed through a hot glass tube, whilst in contact with porcelain at the same temperature the decomposition may be 50 times as great.

It is concluded that in the destructive distillation of coal the decomposition of the ammonia may be prevented by keeping the temperature low, and by reducing the time in which the gases remain in contact with hot, rough surfaces like those of coke or fire-clay.

E. G.

**New Reactions of Nitroxyl (Dihydroxyammonia).** ANGELO ANGELI and FRANCESCO ANGELICO (*Gazzetta*, 1905, 35, i, 152—159. Compare Abstr., 1904, i, 172).—Further study of the reactions of nitroxyl renders it probable that it has the constitution of dihydroxyammonia,  $\text{NH}(\text{OH})_2$ , or the corresponding anhydride,  $\text{NHO}$ . Thus, it is formed by the oxidation of hydroxylamine by means of Caro's acid, and hence forms a term in the series of oxidation products of ammonia: ammonia, hydroxylamine, dihydroxyammonia, nitrous acid. Its behaviour resembles in some respects that of hydroxylamine, and in others that of nitrous acid. Thus with aldehydes it gives hydroxamic acids, just as hydroxylamine gives oximes, and dihydroxyammonia and hydroxylamine both act on true nitroso-compounds, giving nitrosohydroxylamines and diazo-compounds respectively. Further, nitrous acid acts on secondary amines, yielding nitrosoamines, whilst dihydroxyammonia and secondary amines give compounds of the type  $\text{NRR} \cdot \text{NH} \cdot \text{OH}$ , which lose water and polymerise, forming tetrazones. Also, with mono-substituted hydroxylamines, dihydroxyammonia gives diazo-hydroxides; for instance, with phenylhydroxylamine in presence of  $\alpha$ -naphthol, it yields benzeneazo- $\alpha$ -naphthol. This probably completes the number of methods by which diazo-compounds can be prepared. Thus,  $\text{C}_6\text{H}_5 \cdot \text{N} \cdot \text{N} \cdot \text{OH}$  can be obtained from  $\text{C}_6\text{H}_5 \cdot \text{NH}_2 +$

$\text{HNO}_2$ ,  $\text{C}_6\text{H}_5\cdot\text{NH}\cdot\text{OH} + \text{NOH}$ ,  $\text{C}_6\text{H}_5\cdot\text{NO} + \text{NH}_2\cdot\text{OH}$ , or  $\text{C}_6\text{H}_5\cdot\text{NO}_2 + \text{NH}_3$ . So also can phenylnitrosohydroxylamine be obtained from  $\text{C}_6\text{H}_5\cdot\text{NH}_2 + \text{HNO}_3$ ,  $\text{C}_6\text{H}_5\cdot\text{NH}\cdot\text{OH} + \text{HNO}_2$ ,  $\text{C}_6\text{H}_5\cdot\text{NO} + \text{NH}(\text{OH})_2$ , or  $\text{C}_6\text{H}_5\cdot\text{NO}_2 + \text{NH}_2\cdot\text{OH}$ .  
T. H. P.

**New Method for preparing Oxides of Nitrogen and hence Nitric Acid from Compressed Air by Electric Means.** EMILIO ROSSI (*Gazzetta*, 1905, 35, i, 89—110).—An incandescent substance, such as a Nernst lamp, causes the formation of oxides of nitrogen in the air, and if it is placed in an enclosed vessel containing air under pressure and also sulphuric acid, the amount of nitric oxide subsequently obtainable from the acid is large enough to be of importance for the manufacture of nitric or sulphuric acid. Two ampere-hours acting on 1.25 litres of air under 50 atmospheres pressure in a closed vessel containing 8 c.c. of sulphuric acid yields as much as 200 c.c. of nitric oxide.  
T. H. P.

**Catalytic Decomposition of Arsenic Hydride.** GEORG LOCKEMANN (*Zeit. angew. Chem.*, 1905, 18, 491—494).—The decomposition of arsenic hydride is accelerated by the presence of moist cotton or quartz wool. Alcohol has a similar effect. It is shown that cotton wool (or glass wool) is unsuitable for drying purposes in the Marsh test; the progress of the decomposition of arsenic hydride by these catalytic agents was measured. From the figures quoted, it appears that, as the unimolecular reaction represented by the equation  $2\text{AsH}_3 = 2\text{As} + 3\text{H}_2$  proceeds, the oxidation of the arsenic hydride gradually diminishes.  
A. McK.

**Theory of the Velocity of Solution of Arsenious Oxide.** ERICH BRUNNER (*Zeit. physikal. Chem.*, 1905, 51, 494—499. Compare Drucker, Abstr., 1901, ii, 376; Brunner, Abstr., 1904, ii, 315).—The author considers that the velocity of solution of arsenious oxide is not governed exclusively either by the rate of diffusion or by the rate of hydration in the solution, but that both factors are involved. On this basis, it is possible to interpret all the observations hitherto made on the velocity of solution of arsenious oxide.  
J. C. P.

**Permeability of Fused Silica Tubes.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 140, 1159—1162. Compare this vol., ii, 316).—Fused silica tubes with walls 0.7 mm. thick are not permeable to hydrogen at the ordinary temperature, but become so at  $800^\circ$ , whilst at  $1300^\circ$  the diffusion is very marked; hydrogen chloride does not begin to diffuse through the walls of a silica tube below  $1400^\circ$ , neither does carbon dioxide below  $1300^\circ$ ; the diffusion of nitrogen is feeble at  $1000^\circ$ , but becomes appreciable at  $1300^\circ$  to  $1400^\circ$ , whilst oxygen diffuses more readily; relative experiments on the rates of diffusion of these two gases show that at  $1400^\circ$  under a pressure of 1.2 atmospheres one-sixth of the initial volume of nitrogen or one-third of the initial volume of oxygen diffuses during one hour. The silica tubes suffer a permanent distension from the effect of the increased internal pressure at the high temperature.  
M. A. W.



**Coagulation of Colloidal Silicic Acid. II.** NICOLA PAPPADÀ (*Gazzetta*, 1905, 35, i, 78—86. Compare Abstr., 1904, ii, 120).—Decinormal, normal, or even stronger solutions of methyl, ethyl, or propyl alcohol, ethylene glycol, glycerol, mannitol, dextrose, lævulose, or sucrose have no coagulating action on a 0.6 per cent. solution of colloidal silica, and have no retarding influence on substances which cause coagulation. The action of the latter substances is due not to the integral molecule or to the anion, but only to the cation. The coagulating action of salts is intimately connected with the positions of the metals in the periodic system; thus caesium is more energetic than rubidium, rubidium than potassium, potassium than sodium, and sodium than lithium; ammonium salts stand very near to those of potassium as regards their coagulating action. The positive ions of salts act catalytically in coagulating colloidal solutions of silica, their action being closely analogous with those of organic ferments. The coagulants are rendered inactive by the presence of traces of acids, whilst the coagulation is favoured by small quantities of substances having a basic reaction. T. H. P.

**Behaviour of Hydrofluosilicic Acid with Various Reagents.** A. GAWALOWSKI (*Zeit. anal. Chem.*, 1905, 44, 191—194).—An aqueous solution of hydrofluosilicic acid gives precipitates with sulphuric acid, normal and acid potassium chromates, chromic acid, dilute hydrochloric acid, and potassium chlorochromate. Most of these precipitates are soluble in alkalis, but insoluble in acids; that obtained with potassium dichromate is, however, not attacked by cold potassium hydroxide, and as it has a deep yellow colour it might prove serviceable as a pigment. M. J. S.

**Liberation of Hydrogen during the Action of Sodium on Mercury.** LOUIS KAHLENBERG and HERMANN SCHLUNDT (*J. Physical Chem.*, 1905, 9, 257—259).—It was found that when sodium amalgam is formed by the action of sodium on mercury, hydrogen is liberated, and the authors obtained on an average 3.24 c.c. of hydrogen (at 20° and 750 mm. pressure) per gram of sodium. It was found by Lockyer that, when heated, carefully distilled sodium gives off about 20 times its volume of hydrogen. The difference in the amount of hydrogen obtained in the two methods necessitates further inquiry. L. M. J.

**Polysulphides. II.** FRIEDRICH W. KÜSTER (*Zeit. anorg. Chem.*, 1905, 44, 431—452. Compare Küster and Heberlein, this vol., ii, 156).—The process of solution of sulphur in sodium sulphide can be followed by potential measurements until the solution is saturated. Between the potential of the platinum electrodes in the solutions of sodium polysulphides, saturated with sulphur, and the dilution of those solutions, simple relationships obtain, which find expression in the Nernst formula. The case is similar when silver electrodes are used.

The potential differences between platinum and silver electrodes were measured in solutions of sodium sulphide, to which sulphur was added in gradually increasing amounts. From the latter measurements, the

concentrations of the sulphur ions ( $S''$ ) and of free sulphur were calculated.

The hydrolysis and ionisation of such solutions were diminished by the addition of potassium hydroxide and of sodium chloride. Measurements of potential, made after the addition of these substances, afforded a means of calculating the concentration of the sulphur ions, and the results thus obtained were in satisfactory accordance with those calculated by the aid of the law of mass action.

In accordance with the results obtained by purely chemical methods, these electrical measurements show that in the formation of polysulphides by the solution of sulphur in sodium sulphide the sulphur is more firmly combined as far as the formation of the compound  $Na_2S_4$ ; after that stage, the sulphur is not so firmly combined.

A. McK.

**Cæsamide.** ETIENNE RENGADÉ (*Compt. rend.*, 1905, 140, 1183—1185. Compare this vol., ii, 174).—Cæsium ammonium (compare Moissan, *Abstr.*, 1903, ii, 477) decomposes spontaneously into cæsamide and hydrogen; at the ordinary temperature, the decomposition is gradual, but becomes rapid and complete at  $120^\circ$ ; the *cæsamide* thus formed is a white solid, crystallising from liquid ammonia in small prisms or plates; it melts in a vacuum at about  $260^\circ$ , is readily oxidised with the formation of cæsium nitrite, cæsium hydroxide, and ammonia, and reacts violently with water to form cæsium hydroxide and ammonia. Potassamide behaves similarly to the cæsium compound towards oxygen, whilst sodamide is not attacked by a solution of oxygen in liquid ammonia.

M. A. W.

**Position of the Alkali and Alkaline-earth Metals in the Electrochemical Series at High Temperatures.** H. DANNEEL and LORENZ STOCKEM (*Zeit. Elektrochem.*, 1905, 11, 209—211).—Calcium is not reduced from the chloride or iodide by metallic sodium at temperatures above  $800^\circ$ , the reverse reaction occurring; near the melting point of the iodide, calcium is displaced by sodium. Hence sodium is more electropositive than calcium at low temperatures, but less so at high ones. At  $800^\circ$ , potassium is still more positive than calcium, but it is less positive than strontium, whilst at low temperatures it is almost certainly more so.

T. E.

**Solubility of Calcium Sulphate in Solutions of Other Salts.** FRANK K. CAMERON and B. E. BROWN (*J. Physical Chem.*, 1905, 9, 210—215).—The solubility of calcium sulphate in solutions of ammonium chloride and of ammonium nitrate was determined. In the first case, the solubility rises with increasing concentration of the ammonium chloride until a maximum is reached at about 210 grams of ammonium chloride per litre, when the calcium sulphate dissolved is 10.9 grams per litre, the temperature being  $25^\circ$ . With a further increase in the ammonium chloride, the solubility of the calcium sulphate decreases. In the case of ammonium nitrate solutions, a maximum solubility of about 12.2 grams per litre is reached for a solution containing about 750 grams of ammonium nitrate per litre. The solubility at  $25^\circ$  in saturated solutions of sodium chloride, sodium

nitrate, sodium sulphate, magnesium chloride, and magnesium nitrate was also determined, the values, in grams per litre, being respectively 5.52, 7.16, 2.58, 1.09, 15.26. The great difference between the concentrations in the saturated solution of the two magnesium salts is very remarkable (see Abstr., 1904, ii, 544). I. M. J.

**Hydration and Hardening.** PAUL ROHLAND (*Zeit. Elektrochem.*, 1905, 11, 129—130).—A reply to Jordis (this vol., ii, 155). The author insists that the hardening of cement cannot be explained by the hydration and other chemical changes alone, since these changes are sometimes not accompanied by hardening. T. E.

**Boiler Deposits.** J. M. ROTHSTEIN (*Zeit. angew. Chem.*, 1905, 18, 540—545).—The paper includes a number of analyses of boiler deposits and of the waters from which they were derived. A. McK.

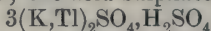
**Spectrum of Magnesium.** JAMES BARNES (*Chem. Centr.*, 1905, i, 994—995; from *Physikal. Zeit.*, 6, 148—151).—The temperature of certain stars has been deduced from the fact that magnesium lines have been found in their spectra. The presence of these lines is, however, not only dependent on temperature, but also on electrical conditions. Photographs of the magnesium spectrum, formed by means of the arc in hydrogen and air under different pressures, show that when the current is decreased the lines become fainter. Whilst the intensity of the lines of the arc-spectrum is found to be less in hydrogen than in air, the lines of the spark-spectrum have a greater intensity in hydrogen. The intensity of the line 4481 of the spark-spectrum becomes greater as the current is decreased. In the spectrum obtained by means of an arc in a vacuum, this line appears at the cathode and its intensity is constant. E. W. W.

**Electrolytic Refining of Lead in Hydrofluosilicic Acid Solutions.** HANS SENN (*Zeit. Elektrochem.*, 1905, 11, 229—245).—Coherent deposits of lead or cadmium can be obtained from acid solutions of the silicofluorides, using anodes of lead or cadmium. A small addition of gelatin to the solution diminishes the tendency to form dendritic crystals at the cathode. The quality of the deposit is unfavourably affected by high current density or by dilution of the electrolyte; the best results are obtained with a solution containing about 11 per cent. of free hydrofluorosilicic acid and 4—8 per cent. of lead (or 2.5 per cent. of cadmium) and 0.1 gram of gelatin per litre for lead, or 0.3 gram per litre for cadmium. The best current density at the cathode is from 0.005 to 0.01 ampere per sq. cm. The temperature is of little importance. Copper, bismuth, or antimony, when present in the anode lead, even in large quantities, remain undissolved so long as the anodic current density does not exceed about 0.01 ampere per sq. cm.

The separation of lead and platinum is impossible, a crystalline compound of lead and platinum having approximately the composition  $\text{PtPb}_2$  remaining undissolved. In all cases, the anode mud contains silica and lead fluoride, which are produced by hydrolysis of lead silicofluoride. The current yield at the cathode is about 98 per cent. of the theoretical. T. E.



**Isomorphism of Potassium and Thallous Salts.** WILLEM STORTENBEKER (*Rec. Trav. chim.*, 1905, **24**, 53—65. Compare Abstr., 1903, ii, 470).—The author has, in continuation of previous work, compared the sulphates, thionates, perchlorates, chlorates, chlorides, and nitrates of potassium and of thallium. The results of optical measurements and of analyses of series of mixed crystals, which are tabulated in the original, show that the perchlorates and neutral sulphates are isomorphous; the acid sulphates of the type



and possibly also those of the type  $5(\text{K, Tl})_2\text{SO}_4 \cdot 3\text{H}_2\text{SO}_4$  are isodimorphous, and the simple salts  $\text{KHSO}_4$  and  $\text{TlHSO}_4$  probably isotrimorphous (compare Gossner, *Zeit. Kryst. Min.*, 1904, **39**, 381). The chlorates, nitrates, and thionates are regarded as isodimorphous (compare Abstr., 1903, ii, 470; and Roozeboom, Abstr., 1892, 266). Crystals of potassium chloride containing about 2 per cent. of thallium chloride were prepared by Lehmann's method (*Zeit. Kryst. Min.*, 1885, **10**, 335). It is pointed out that both the analogy of crystalline form and the property of forming mixed salts increase with the degree of oxidation of the salts of the two metals and seem to exist in higher degrees in the salts containing chlorine than in those containing sulphur.

T. A. H.

**Electrolytic Behaviour of Copper Sulphide.** GUIDO BODLÄNDER and KASIMIR S. IDASZEWSKI (*Zeit. Elektrochem.*, 1905, **11**, 161—182).—The experiments described were made in porcelain tubes or crucibles heated in an electrical muffle furnace of special design. The melting point of cuprous sulphide is  $1091^\circ$ . When the fused sulphide is electrolysed with carbon electrodes, the current is proportional to the applied *E.M.F.*; there is no decomposition point and no polarisation, and after the electrolysis no copper is found at the cathode. By fusing cuprous sulphide and copper together, it is found that copper dissolves in the fused sulphide and crystallises out on cooling, the separation beginning at a point a little above the melting point of the sulphide; in the solid state, they do not mix at all. The conductivity of solid cuprous sulphide is also studied, and Hittorf's statements (*Ann. Phys. Chem.*, 1851, **84**) confirmed. Cuprous sulphide, when fused and cast in sticks, has a comparatively small resistance in the cold; when remelted with metallic copper several times, its resistance increases enormously. When a sample of the substance having a high resistance is electrolysed at  $113^\circ$ , a polarisation is observed, and metallic copper was found at the cathode; at the ordinary temperature, there is no polarisation and no decomposition. The phenomena may be explained thus: pure cuprous sulphide, at the ordinary temperature, is practically a non-conductor; the conductivity observed is due to the presence of varying quantities of cupric sulphide, which is a very good conductor. At about  $110^\circ$ , some change occurs in cuprous sulphide (accompanied by heat absorption), owing to which it becomes an electrolyte. The electrolysis, however, produces cupric sulphide at the anode, and so the electrolytic conductivity of the cuprous sulphide soon becomes insignificant compared with the metallic conductivity of cupric sulphide. The resistance of solid cuprous sulphide diminishes

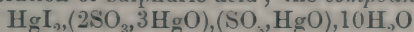
very rapidly as the temperature rises; electrolysis was observed up to  $1000^{\circ}$ . The partial decomposition of fused cuprous sulphide into copper and cupric sulphide explains the negative result of the electrolysis of the fused substance.

Potassium sulphide (previously fused in a carbon crucible in order to eliminate oxygen compounds) was electrolysed at about  $300^{\circ}$ , and sodium sulphide at about  $650^{\circ}$ . A decomposition point, at which potassium or sodium is formed, was found in both cases at about 1.6 volts, but considerable currents pass at lower *E.M.F.s* owing to the presence of potassium or sodium hydrogen sulphide. Fused sodium and cuprous sulphides are mutually soluble to a limited extent. They combine partially to form the compound  $\text{NaCuS}$ , which remains in the form of steel-blue needles when the solid mass is treated with water. When a fused mixture of sodium sulphide and cuprous sulphide is electrolysed, copper migrates to the anode in the form of a complex anion, whilst a little copper is reduced at the cathode owing to the secondary action of the sodium formed there.

T. E.

**Action of Mercuric Iodide on Sulphuric Acid and Mercury Sulphates.** ALFRED DITTE (*Compt. rend.*, 1905, 140, 1162—1167. Compare Abstr., 1879, 299; 1880, 12).—The compound  $\text{HgI}_2 \cdot 3\text{HgSO}_4$  is readily obtained in the form of white, silky needles by heating mercuric iodide with Nordhausen sulphuric acid, or less readily when pure sulphuric acid is used; it can be recrystallised from sulphuric acid, melts to a yellow liquid which solidifies on cooling to a white, fibrous mass, and is decomposed by water, forming mercuric iodide and the tribasic mercury sulphate,  $3\text{HgO} \cdot 2\text{SO}_3$ .

By the prolonged action of saturated solutions of mercuric sulphate in sulphuric acid of different strengths on mercuric iodide, five different double salts of mercuric sulphate and iodide can be obtained, the compound  $\text{HgI}_2 \cdot 4\text{HgSO}_4$  crystallising with 15 or  $18\text{H}_2\text{O}$  from a 41.1 per cent. solution of sulphuric acid; the compound



in brilliant, white needles from a 37.5 per cent. solution of sulphuric acid; the compound  $\text{HgI}_2 \cdot 2(2\text{SO}_3 \cdot 3\text{HgO}) \cdot 10\text{H}_2\text{O}$  in white, nodular, crystalline masses from a 28.5 per cent. solution of sulphuric acid; the compound  $2\text{HgI}_2 \cdot 3(2\text{SO}_3 \cdot 3\text{HgO}) \cdot 10\text{H}_2\text{O}$  in rose-coloured crystals from a 16.6 per cent. solution of sulphuric acid; and the compound  $\text{HgI}_2 \cdot (2\text{SO}_3 \cdot 3\text{HgO})$  in white crystals from a 9 per cent. solution of sulphuric acid.

M. A. W.

**Preparation of Anhydrous Chlorides of the Rare Metals.** CAMILLE MATIGNON (*Compt. rend.*, 1905, 140, 1181—1183. Compare Abstr., 1901, ii, 602; 1902, ii, 263, 505, 556; 1904, ii, 132, 340, 341; Muthmann and Stützel, Abstr., 1900, ii, 142; Moissan, Abstr., 1900, ii, 726).—The anhydrous chlorides of the rare metals can be obtained readily, and in large quantity, by the action of a mixture of chlorine, sulphur chloride, and hydrogen chloride on the solid obtained by evaporating at  $134$ — $140^{\circ}$  the hydrochloric acid solution of the corresponding oxide, and the following compounds have been prepared: lanthanum chloride in colourless, transparent crystals; neodymium

chloride in clear, rose-coloured crystals; praseodymium chloride in green, transparent crystals; samarium chloride in pale yellow, transparent crystals; and yttrium chloride in colourless, transparent plates.

M. A. W.

**Arc Spectrum of Scandium and its Relation to Celestial Spectra.** Sir J. NORMAN LOCKYER and F. E. BAXANDALL (*Proc. Roy. Soc.*, 1905, 538—545).—A complete list is given of the scandium lines observed, those due to impurities (chiefly cerium, thorium, and ytterbium) being eliminated by comparison with the spectra of all the chemical elements available at Kensington. The number of lines in the solar spectrum which undoubtedly correspond with scandium lines is greater than the number ascribed to scandium by Rowland. The authors find that of the 23 scandium lines of intensity 6 or above, 18 occur in the solar spectrum, 3 are doubtfully present, and 2 appear to be absent. The scandium lines which occur in the chromospheric spectrum, although not so numerous as those in the solar spectrum, are of considerably greater prominence. It is quite probable that the stronger scandium lines occur also in the spectra of stars resembling the sun.

J. C. P.

**Europium and its Ultra-violet Spectrum.** Sir WILLIAM CROOKES (*Proc. Roy. Soc.*, 1905, 74, 550—551).—The author has photographed the spectrum of europium from the oxide prepared by Urbain (see Abstr., 1904, ii, 340). The photographs show that this europia contains gadolinium, yttrium, lanthanum, and calcium.

J. C. P.

**Manganese Chromates.** MAX GRÖGER (*Zeit. anorg. Chem.*, 1905, 44, 453—468).—The author has examined the precipitates obtained by the action of sodium chromate on manganous chloride under different conditions of concentration and temperature. The composition of these precipitates varies, owing to the change undergone by the manganous chromate first formed, which probably decomposes according to the equation  $3\text{MnCrO}_4 = \text{Cr}_2(\text{MnO}_3)_3 + \text{CrO}_3$ .

Potassium manganous chromate,  $\text{K}_2\text{CrO}_4 \cdot \text{MnCrO}_4 \cdot 2\text{H}_2\text{O}$ , prepared by the gradual addition of an *N*/1 solution of manganous chloride to a 4*N* solution of potassium chromate, separates in reddish-brown prisms. When more dilute potassium chromate is used, the precipitate obtained is not uniform. Chromic manganite,  $\text{Cr}_2\text{O}_3 \cdot 3\text{MnO}_3$ , appeared to be formed in certain cases.

Different products are obtained by the action of ammonium chromate on manganous chloride according to the conditions employed.

A. McK.

**Structure of Hardened Steel.** W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1904, 36, 1524—1539, and 1905, 37, 169—180).—The usual reagent employed for etching polished steel surfaces to show their structure is a 5 per cent. alcoholic solution of either picric or nitric acid, by which the sorbite constituents are rendered dark, while the martensite and austenite remain pale. The author has made



experiments to discover reagents which will distinguish between martensite and austenite and bring out other details of structure.

The results obtained show that the rapidity of the action on steel of solutions of nitric or picric acid in different solvents is proportional to the degree of association of the molecule of the solvent, or the degree of electrolytic dissociation of the dissolved substance. Nitro-compounds take part in the formation of the layer conditioning the colouring, which has a complex structure. The most sensitive reagents for distinguishing the constituents of complex steels are: (1) a 4 per cent. solution of nitric acid of sp. gr. about 1.3 in *isoamyl* alcohol, and (2) a 20 per cent. solution of concentrated hydrochloric acid in *isoamyl* alcohol mixed with one-third of its volume of a saturated solution of nitroaniline in alcohol. With troostite-sorbite mixtures, the best results are obtained with either (1) a mixture in equal volumes of a 4 per cent. solution of nitric acid in acetic anhydride, methyl alcohol, ethyl alcohol, and *isoamyl* alcohol, or (2) 3 volumes of a saturated solution of nitrophenol mixed with 1 volume of a 4 per cent. solution of nitric acid in alcohol.

The hardness of austenite is not the same in all specimens and does not remain constant in any one specimen. During annealing, martensite and austenite are transformed into plates of cementite containing troostite within them, whilst above 350° troostite and cementite change into ferrite and cementite, the quantity of the last-named increasing. Austenite, martensite, troostite, and troostite-sorbite may occur in the form of identical pseudo-crystals. All possible forms of transition between troostite, sorbite, troostite-sorbite, martensite, austenite, &c., have been found to exist.

The paper is accompanied by micro-photographs.

T. H. P.

**Colloidal Ferric Hydroxide. II. Influence of Ammonium Chloride.** A. V. DUMANSKY (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 213—220. Compare this vol., ii, 37).—Conductivity measurements of mixtures in various proportions of colloidal ferric hydroxide solution and ammonium chloride solution show that in these mixed solutions the ammonium chloride distributes itself between two solvents, namely, water and the molecules of the colloid. T. H. P.

**Cobalt Chloride.** WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1905, 7, 51. Compare Abstr., 1904, ii, 741 and 821).—The violet-coloured liquid produced by the exposure of a solution of cobalt chloride in ethylene glycol to sunlight absorbs less light than the initial red solution, the diminution being in the ratio 1:0.6. The violet solution regains its original red colour when removed from the light or when the solvent is distilled off. T. A. H.

**Cobaltic [Fluoride].** GIUSEPPE BARBIERI and FILIPPO CALZOLARI (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 464—465).—When a saturated solution of cobaltous fluoride in fuming hydrofluoric acid (40 per cent.) is subjected to electrolysis in a platinum dish which serves as the anode, and using a platinum wire cathode and an anode current density of about 1 ampere per sq. dm., *cobaltic fluoride*,  $\text{CoF}_3$ , is

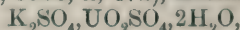
deposited as a green powder which does not redissolve when the current is stopped. The salt remains unchanged for several days in a desiccator, but in the air it gradually becomes grey and then red in colour. It is soluble in concentrated sulphuric acid, giving a brown solution which becomes green on dilution, whilst the addition of a few drops of water to the salt blackens it owing to the separation of cobaltic hydroxide. Its solution in sulphuric acid turns red when gently heated, or on the addition of a reducing agent such as alcohol, a nitrite, or a salt of hydroxylamine or hydrazine; hydrogen peroxide reduces the solution instantaneously.

Electrolysis of the corresponding nickel fluoride under similar conditions does not yield a nickelic fluoride. T. H. P.

**Electrolytic Chromium. I.** HECTOR R. CARVETH and W. ROY MOTT (*J. Physical Chem.*, 1905, 9, 231—256).—The work of previous observers is briefly reviewed and the possible reactions during electrolysis are considered. It was found that in a solution containing 100 grams of metal per litre at a temperature of about 21°, with a current density of about 50 amperes per square decimetre, the efficiency slowly increased until a constant value of about 30 per cent. was reached. The author considers this to be due to the formation of chromous chloride and that this is necessary for the efficient electrolysis. Subsequent experiments showed that the bubbling of air caused a great decrease in the efficiency. Rise of temperature may also cause a marked decrease of efficiency owing probably to the increased rate of oxidation of the chromous salt. Variation of the anode liquid was also found to cause considerable alteration in the electrolysis, and high efficiencies were obtained with ammonium hydroxide as anolyte; this effect of the anolyte is most probably due to diffusion into the cathode chamber. L. M. J.

**Solid Solutions of Indifferent Gases in Uranium Oxide.** VOLKMAR KOHLSCHÜTTER and K. VOGDT (*Ber.*, 1905, 38, 1419—1430).—Hydroxylamine uranate,  $\text{UO}_4\text{H}_2(\text{NH}_3\text{O})_2 \cdot \text{H}_2\text{O}$ , prepared by the addition of hydroxylamine hydrochloride to the orange precipitate produced by alkalis in solutions of uranyl salts, forms well characterised, yellowish-green crystals. When slowly heated at 125°, it decomposes into water and ammonia, which pass away, and into nitrogen and nitrous oxide, which remain practically entirely dissolved in the uranic acid, and escape on dissolving the residue in dilute acids. Uranium oxide only exercises this power of retaining indifferent gases so long as it contains traces of water, the real solvents being hydrates of uranium trioxide. It is suggested that the water present plays an important part in the retention of such gases as helium in uranium minerals. E. F. A.

**Two Double Sulphates of Uranyl.** WILLIAM OCHSNER DE CONINCK and CHAUVENET (*Bull. Acad. roy. Belg.*, 1905, 7, 50. Compare Abstr., 1904, ii, 821, and this vol., ii, 254).—When a mixture of uranic hydrate with potassium hydrogen sulphate is compressed by Spring's process (Abstr., 1904, ii, 472), Elhelmen's salt,



is obtained, and this, on recrystallisation, furnishes the more hydrated salt,  $K_2SO_4 \cdot UO_2SO_4 \cdot 3H_2O$ . The corresponding trihydrated form of ammonium uranyl sulphate was also obtained by crystallisation from a solution of ammonium and uranyl sulphates.

T. A. H.

**Cæsium Uranyl Sulphate.** WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1905, 7, 94. Compare preceding abstract).—This salt was prepared by crystallisation from an aqueous solution containing molecular proportions of cæsium and uranyl sulphates. It has the formula  $Cs_2SO_4 \cdot UO_2SO_4 \cdot 2H_2O$ .

T. A. H.

**Crystallisation of Tin and Zinc by the Electrolysis of their Salts.** A. V. SAPOSCHNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 153—156).—Crystallised tin may be obtained in a compact form, in which it can be readily removed from the bath and examined, in the following manner. A clean sheet of glass, resting on two pieces of glass rod in a flat photographic dish, is covered with stannous chloride solution, a piece of copper wire serving as anode and a piece of tin, at a distance of 10—15 cm., as cathode. On passing through the solution the current from a couple of accumulators, crystallised tin begins to deposit at the point of contact of the copper wire with the glass, and forms long, straight rods from which numerous branches jut out at right angles.

Crystalline zinc may be obtained in a similar way from its chloride or sulphate, the crystals obtained being, like those of tin, convenient for examination under the microscope. Photographs of the crystals of the two metals are given.

T. H. P.

**New Series of Isomorphous Salts.** ITALO BELLUCCI and NICOLA PARRAVANO (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 457—463. Compare Miolati and Bellucci, *Abstr.*, 1900, ii, 732, and 1901, ii, 246; Bellucci, *Abstr.*, 1902, ii, 267; 1903, ii, 155, and 1904, ii, 180; Bellucci and Parravano, *Abstr.*, 1904, ii, 822 and 823, and this vol., ii, 40).—That the stannates, plumbates, and platينات are isomorphous is shown by the following crystallographic measurements of the potassium salts made by ZAMBONINI: These potassium salts all crystallise in the rhombohedral system. For potassium stannate,  $Sn(OH)_6K_2$  [ $a:c = 1:1.9588$ ;  $\alpha = 70^\circ 0' 44''$ ]; for potassium plumbate,  $Pb(OH)_6K_2$  [ $a:c = 1:1.9514$ ;  $\alpha = 70^\circ 10' 26''$ ]; for potassium platinate,  $Pt(OH)_6K_2$  [ $a:c = 1:1.9952$ ;  $\alpha = 69^\circ 11' 4''$ ].

T. H. P.

**Thorium.** CHARLES BASKERVILLE (*Ber.*, 1905, 38, 1444).—In connection with Meyer and Gumperz' criticisms (this vol., ii, 257) of the author's work (*Abstr.*, 1902, ii, 85; 1904, ii, 663), attention is drawn to the need for carefully following the original directions.

J. J. S.

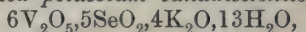
**Complex Compounds of Quinquevalent Vanadium with Quadrivalent Elements.** WILHELM PRANDTL [with FRITZ LUSTIG] (*Ber.*, 1905, 38, 1305—1310).—*Vanadiselenious acid*,  $3V_2O_5 \cdot 4SeO_3 \cdot 4H_2O$ , is formed by boiling vanadium pentoxide with selenious acid in aqueous solution; on cooling, it separates as a yellowish-red, crystalline, doubly



refracting powder, consisting of small, golden leaflets, containing  $6\text{H}_2\text{O}$ , if obtained from a solution containing an excess of selenious acid or if evaporated with hydrochloric acid, or  $10\text{H}_2\text{O}$  if prepared from equal weights of vanadium pentoxide and selenium dioxide; the water of crystallisation is driven off at  $100^\circ$ .

Two series of vanadiselenites are obtained: red salts, by boiling equal weights of vanadium pentoxide and selenium dioxide together in water, adding sufficient aqueous alkali hydroxide to form a clear, slightly alkaline solution, and acidifying with acetic acid; yellow salts, formed in the same manner from 1 part by weight of vanadium pentoxide with 10 parts by weight of selenium dioxide.

*Red ammonium vanadiselenite*,  $6\text{V}_2\text{O}_5, 5\text{SeO}_2, 4(\text{NH}_4)_2\text{O}, 13\text{H}_2\text{O}$ , crystallises in large, glistening, dark red, almost opaque, doubly refracting cubes, is slightly soluble in water, and decomposes when boiled with water. *Red potassium vanadiselenite*,



forms spherical aggregates of dark red crystals, or, when air-dried, a red powder consisting of doubly refracting needles.

*Yellow ammonium vanadiselenite*,  $3\text{V}_2\text{O}_5, 6\text{SeO}_2, 3(\text{NH}_4)_2\text{O}, 2\text{H}_2\text{O}$ , forms small, yellow, doubly refracting needles with parallel extinction.

*Yellow potassium vanadiselenite*,  $3\text{V}_2\text{O}_5, 6\text{SeO}_2, 3\text{K}_2\text{O}$ , forms a yellow, crystalline powder.

G. Y.

**Precipitation of Gold in the Crystalline Form.** ROBERT DYKES (*Chem. News*, 1905, 91, 180).—Crystals of gold have been obtained from a combined solution of uranium nitrate and auric chloride in ether by concentrating, then adding water, and again concentrating, but sometimes amorphous gold forms and then the crystals are only obtained after the further addition of auric chloride to the filtered solution, followed by evaporation. Crystals of gold have also been deposited from a solution of auric chloride kept in the dark for some days in a sealed tube. The crystals are isometric and exhibit the usual properties of gold.

D. A. L.

**Colloidal Metals of the Platinum Series.** I. ALEXANDER GUTBIER and G. HOFMEIER (*J. pr. Chem.*, 1905, [ii], 71, 358—365. Compare Abstr., 1903, ii, 81; 1904, ii, 414; this vol., ii, 24, 327).—Stable liquid hydrosols of platinum, palladium, and iridium are obtained by reduction with hydrazine hydrate of very dilute solutions of salts of these metals in presence of gum arabic. These hydrosols, after dialysis, can be filtered and concentrated to a certain extent by warming; they are stable towards light, but are decomposed when shaken with barium sulphate or animal charcoal. The solid hydrosols obtained by evaporation over sulphuric acid in a vacuum are completely soluble in warm water.

G. Y.

**Absorption of Oxygen by Platinum.** RICHARD LUCAS (*Zeit. Elektrochem.*, 1905, 11, 182—185).—A tube of quartz was filled with platinum gauze, exhausted, and filled with pure oxygen. When the tube is heated to a constant temperature, the pressure of the oxygen diminishes. The absorption begins at  $615^\circ$  and increases in rapidity up

to  $1000^{\circ}$ , after which it again diminishes. The platinum gauze used contained about 5 per cent. of iridium. It was found that perfectly pure platinum does not absorb oxygen at all; the action is therefore due to the iridium.

T. E.

**Palladium.** CARL PAAL and CONRAD AMBERGER (*Ber.*, 1905, 38, 1388—1394).—According to Jannasch and Bettges (*Abstr.*, 1904, ii, 519, 594), the product obtained by the reduction of palladium salts with hydrazine sulphate and subsequent ignition is a mixture of oxides. It is here shown that palladium salts are reduced to metallic palladium by hydrazine either in alkaline or in acid solution (compare *Abstr.*, 1904, ii, 180), the product obtained being entirely soluble in aqua regia. The oxide found in Jannasch's experiments is formed during the ignition of the precipitate in the air.

E. F. A.

**Palladium Hydride.** CARL PAAL and CONRAD AMBERGER (*Ber.*, 1905, 38, 1394—1397).—The behaviour towards hydrogen of palladium black, prepared either by reducing the chloride with hydrogen or with hydrazine sulphate in acid or alkaline solution, was studied by heating the metal at  $110^{\circ}$  in a stream of hydrogen and subsequently keeping it at  $-10^{\circ}$  in an atmosphere of hydrogen. The palladium hydride was then heated in a stream of carbon dioxide, a specially devised apparatus being employed to prevent the access of air, and the amount of hydrogen eliminated was measured. The results show that the amount of hydrogen occluded is greatly increased by cooling to  $-10^{\circ}$ . Palladium hydride preparations rich in hydrogen are pyrophoric.

E. F. A.

**Colloidal Metals of the Platinum Group. II.** CARL PAAL and CONRAD AMBERGER (*Ber.*, 1905, 38, 1398—1405. Compare *Abstr.*, 1904, ii, 180).—Colloidal palladium is prepared by passing a current of hydrogen through a solution of sodium protalbate and palladium chloride at  $60^{\circ}$ . After dialysis, the solution is evaporated on the water-bath and the residue dried in a vacuum. Colloidal palladium hydride may be prepared by heating the solid palladium hydrosol in a stream of hydrogen at either  $60^{\circ}$  or  $110^{\circ}$ , preferably at the higher temperature. The product loses its hydrogen when heated in carbon dioxide at  $130$ — $140^{\circ}$ , at which temperature the sodium protalbate present in the preparation is still undecomposed. The residue of palladium still forms a colloidal solution with water.

E. F. A.

**Rendering Active of Hydrogen by Colloidal Palladium.** CARL PAAL and CONRAD AMBERGER (*Ber.*, 1905, 38, 1406—1409).—Colloidal platinum, dissolved in water, brings about the conversion into aniline of nitrobenzene in alcoholic solution, through which hydrogen is passed. The amount of aniline formed varies greatly with the temperature and the amount and age of the palladium preparation used. In presence of palladium hydrogel, or of palladium black, aniline is not formed.

E. F. A.

**Influence of Temperature and Pressure on the Absorption and Diffusion of Hydrogen in Palladium.** ADOLF WINKELMANN (*Ann. Physik*, 1905, [iv], 16, 773—783).—A critical examination of

Schmidt's work (Abstr., 1904, ii, 312). The author considers that his earlier experiments, which led him to the assumption of the dissociation of the hydrogen molecules (Abstr., 1902, ii, 552), cannot be interpreted merely by reference to adsorption, as suggested by Schmidt.

J. C. P.

## Mineralogical Chemistry.

**Behaviour of Pennsylvanian Naphtha and its Products towards Polarised Light.** M. A. RAKUSIN (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 221—223. Compare Abstr., 1904, i, 641, and this vol., ii, 328).—Pennsylvanian naphtha and its distillation products exhibit slight optical activity, a fact which points to the organic origin of the naphtha. The residue, non-volatile at 250° under the ordinary pressure, has a rotation three times as great as that of the original naphtha.

T. H. P.

[**Martite from Mexico.**] OLIVER C. FARRINGTON (*Field Columbian Museum, Chicago, Geol. Ser.*, 1904, 2, 197—228).—In a paper on the geology and geography of the State of Durango is given a description of the Cerro Mercado, a mountain of iron-ore situated close to the city of Durango. The ore consists mainly of hæmatite, which varies considerably in character, being hard or soft, red or black, specular or earthy; cavities in the ore are usually lined with crystals of martite. These crystals are unmodified octahedra of an iron-black colour; the colour of the streak is cherry-red, and none of the powder is attracted by a magnet. A polished surface shows that the crystals are not homogeneous, there being enclosures in the form of red, triangular patches or irregular spots. The following analysis of crystals, by H. W. Nichols, shows that they consist of hæmatite, 90·12, limonite, 8·35, and pyrites, 1·29 per cent.

Fe <sub>2</sub> O <sub>3</sub> .	FeO.	H <sub>2</sub> O.	TiO <sub>2</sub> .	MgO.	SiO <sub>2</sub> .	S.	Total.
97·26	0·78	1·21	trace	trace	0·25	0·69	100·19

This composition, together with the fact that magnetite is not known to occur at the locality, suggests that the martite of Cerro Mercado may be a pseudomorph after pyrites. The paper also gives several analyses of rhyolite.

L. J. S.

**Atopite from Brazil.** EUGEN HUSSAK (*Centr. Min.*, 1905, 240—245).—Small, octahedral crystals of atopite, a mineral previously known only from the manganese mine at Långban in Sweden, have been found at Miguel Burnier in Minas Geraes. The crystals vary in colour from pale sulphur-yellow to reddish-brown; they are sometimes twinned according to the spinel law and have an imperfect octahedral cleavage. The following analysis made on sulphur-yellow crystals



agrees with the usual formula,  $(\text{Ca}, \text{Na}_2, \text{Fe}, \text{Mn})_3\text{Sb}_2\text{O}_7$ . The mineral contains more manganese and less iron than the Swedish atopite.

$\text{Sb}_2\text{O}_5$ .	CaO.	MnO.	FeO.	$\text{Na}_2\text{O}$ .	$\text{K}_2\text{O}$ .	Total.	Sp. gr.
76·20	12·68	5·70	trace	5·70	trace	100·28	5·1

A description is given of the modes of occurrence of the extensive deposits of manganese ores in this and in other parts of Brazil.

L. J. S.

**The Mount Vernon Meteorite.** WIRT TASSIN (*Proc. United States National Mus.*, 1905, 27, 213—217).—This mass, weighing 159·21 kilos., was found in Mount Vernon township, Christian Co., Kentucky, about thirty-five years ago, but its meteoric origin has only recently been recognised. It is of the pallasite type, consisting of a reticulated mass of nickel-iron (33·12 per cent. of the whole), in which are embedded rounded blebs of olivine (63·15 per cent.) with varying amounts of troilite (0·69 per cent.), schreibersite (1·95 per cent.), carbon (0·09 per cent.), chromite (1·00 per cent.), and lawrencite. The various constituents have the compositions given below: I, nickel-iron; II, taenite; III, schreibersite; IV, troilite; V, a specular material, essentially a graphitic iron, lining the olivine cavities; VI, chromite; VII, olivine.

	Fe.	Ni.	Co.	Cu.	S.	$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	C.	P.	Cl.
I.	82·52	14·04	0·95	0·10	0·29	0·81	0·41	0·46	0·39	trace
II.	63·99	35·98	0·10	trace	—	—	—	—	0·04	—
III.	64·99	18·90	0·10	trace	—	—	—	—	15·70	—
IV.	62·99	0·79		—	36·35	—	—	—	trace	—
V.	84·90	5·04		—	1·75	2·99	0·94	2·31	1·47	0·10
	$\text{SiO}_2$ .	MgO.	FeO.	$\text{Fe}_2\text{O}_3$ .	$\text{Al}_2\text{O}_3$ .	$\text{Cr}_2\text{O}_3$ .	Mn.	NiO.	P.	
VI.	1·38	4·96	17·97	—	9·85	64·91	—	—	—	
VII.	35·70	42·02	20·79	0·18	0·42	—	0·14	0·21	trace	

L. J. S.

**Mount Dyrning, Barraba, and Cowra Meteorites.** JOHN C. H. MINGAYE (*Rec. Geol. Survey, New South Wales*, 1904, 7, 305—307).—The meteorite found at Mount Dyrning, in the Singleton District, New South Wales, weighed 25 lbs. and is of the pallasite type. It consists of nodules of pale green, vitreous olivine (forming 72 per cent. of the mass), enveloped by magnetic iron in an advanced state of rust; the latter represents nickel-iron (25 per cent.), but there is now no metallic portion. Analysis gave the results under I (also traces of  $\text{MnO}$ ,  $\text{K}_2\text{O}$ ,  $\text{CoO}$ ,  $\text{TiO}_2$ ,  $\text{CuO}$ ,  $\text{Au}$ ,  $\text{Pt}$ ,  $\text{Ir}$ ,  $\text{Pd}$ ; tin and vanadium are absent).

	$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	FeO.	CaO.	MgO.	$\text{Na}_2\text{O}$ .	NiO.	$\text{Cr}_2\text{O}_3$ .
I.	25·64	1·32	29·90	7·65	0·01	27·90	0·14	2·11	0·11
	$\text{SO}_3$ .	$\text{CO}_2$ .	$\text{P}_2\text{O}_5$ .	Cl.	$\text{H}_2\text{O}$ (at 100°).	$\text{H}_2\text{O}$ (>100°).	Total.	Sp. gr.	
I.	0·15	0·13	0·51	0·01	0·82	3·89	100·29	5·411	

The Barraba meteoric iron has the composition given under II. On dissolving the iron in hydrochloric acid, bright metallic needles and

laths shred from the mass; as shown by analyses III and IV, this material is not uniform in composition, and it consists largely of a mixture of schreibersite and rhabdite together with kamacite.

	Fe.	Ni.	Co.	Cu.	Sn.	Pt, Ir.	Mn.
II.	93.50	5.54	0.51	0.01	0.02	traces	trace
III.	62.27	21.69	0.46	—	trace	trace Pt	—
IV.	64.12	[24.60]		—	—	—	—
V.	85.26	13.23	1.02	0.02	trace	—	trace
VI.	51.45	34.10	trace	—	—	—	—

	P.	S.	Si.	C.	Total.	Sp. gr.
II.	0.27	nil	0.01	0.03	99.89	7.761
III.	15.53	—	—	—	99.95	6.339
IV.	11.28	—	—	—	100.00	—
V.	0.22	0.01	0.01	0.02	99.79	7.805
VI.	13.09	—	—	—	99.49*	—

\* Insol. 0.85.

The Cowra meteoric iron gave the results under V, and the schreibersite isolated from it those under VI.

L. J. S.

## Physiological Chemistry.

**Antagonism of Salts.** JACQUES LOEB (*Pflüger's Archiv*, 1905, 107, 252—262).—Freshly fertilised *Fundulus* eggs develop in distilled water or in sea water, but rapidly die in a pure solution of sodium chloride of equivalent strength. If to this salt solution a small amount of a salt of a bivalent metal is added, development goes on. Even poisonous salts such as barium chloride or zinc sulphate will do; they neutralise the toxicity of sodium chloride, and sodium chloride antagonises their poisonous action. It therefore appears that if both salts are present, their diffusion into the egg is slower than when only one is in solution. There is a similar antagonism between certain bivalent metallic salts; for instance, between magnesium chloride and the chlorides of calcium, strontium, and barium. The poisonous action of sodium chloride can also be neutralised by the addition of the chlorides of calcium and potassium, although not by one of them alone. This is probably true for all sea animals.

W. D. H.

**Regulation of Lung Ventilation.** JOHN S. HALDANE and J. G. PRIESTLEY (*J. Physiol.*, 1905, 32, 225—266).—Normal alveolar air can be obtained in man by a simple method, the principle of which is to collect a sample of expired air at the end of inspiration and the end of expiration; the mean of the two gives the composition of alveolar air. At constant atmospheric pressure, it contains a nearly constant percentage of carbon dioxide in the same person; in different individuals, this percentage varies. With varying atmospheric pressures, the per-

centage varies inversely as the atmospheric pressure, so that the carbon dioxide pressure remains constant, whilst the oxygen pressure varies widely; this no longer holds when the oxygen pressure in the air falls below 13 per cent. of an atmosphere.

The respiratory centre is very sensitive to any rise in the alveolar carbon dioxide pressure, a rise of 0.2 per cent. being sufficient to double the amount of alveolar ventilation during rest. When the oxygen pressure in the inspired air falls below about 13 per cent. of an atmosphere, the respiratory centre begins to be excited by want of oxygen, and the alveolar carbon dioxide pressure begins to fall; but in more ordinary circumstances it is the carbon dioxide pressure in the arterial blood (which will vary with that in the alveolar air) which determines the activity of the respiratory centre. During work, for instance, the alveolar carbon dioxide pressure goes up slightly, and the lung ventilation is consequently much increased. Determinations of the tidal air in a number of people by a method in which the whole body except the head is placed in a plethysmograph gave numbers much in excess of those found by Hutchinson, and later by Marcet, being 500 c.c. or more. The respiratory "dead space" is about 30 per cent. of this. The amount of air breathed per minute and per unit of body weight during rest varies widely in the same individual, and still more widely in different individuals.

Apnoea depends on a fall of the carbon dioxide pressure in the respiratory centre to below the threshold exciting value, the oxygen pressure being at the same time sufficiently high not to excite the centre. If the inspired air contains enough carbon dioxide to prevent the fall below this threshold, even a short apnoea cannot be produced. In man under normal conditions it is therefore unnecessary to assume the existence of a true vagus apnoea.

W. D. H.

**Investigations on the Circulation in Man.** ADOLF LOEWY and H. VON SCHRÖTTER (*Chem. Centr.*, 1905, i, 1172—1173; from *Zeit. exp. Path. Ther.*, 1, 197—311).—The following conclusions relate to man. The elasticity of the lung tissue is so complete that withdrawal of the air from closed portions does not alter their volume. Such closure does not alter the amount of oxygen in the blood; in the closed alveoli, the tension of the gases approaches that in venous blood (oxygen 5.3, carbon dioxide 6, and nitrogen 89 per cent.). The venous blood is 60—65 per cent. saturated with oxygen; about 34 per cent. of the arterial oxygen is used by the tissues, that is, 6.5 c.c. per 100 litres of blood. A number of interesting figures relating to the amount of blood are given, and to the work of the heart. The duration of a complete circulation is given as 72 seconds; the output of each heart beat 55 c.c., or  $1/84$  of the total blood volume; the daily work of the heart 10,000 metre-kilograms, or 3.6 per cent. of the day's energy. At least 139 c.c. of blood pass the coronary circulation per minute, or about 7 times as much as in the rest of the resting parts of the body.

W. D. H.

**Contractility of Intracranial Vessels.** WILHELM WIECHOWSKI (*Chem. Centr.*, 1905, i, 1040; *Arch. exp. Path. Pharm.*, 52, 389—428).—In anemic, but not in normal animals, antipyrin increases the tone of



the intracranial blood-vessels. Certain analgesics appear to act on the heat-regulatory centre as well as on the vasomotor centre which controls the intracranial vessels; both centres are placed in the *corpus striatum*.

W. D. H.

**Spectroscopy of Normal Blood and of Crystalline Oxyhæmoglobin.** A. VILA and M. PIETTRE (*Bull. Soc. chim.*, 1905, [iii], 33, 505—510. Compare this vol., i, 399).—By using tubes from 10 to 50 cm. long in place of the glass dishes of small dimensions usually employed in spectroscopic observations of blood, the authors have observed, in addition to the two well-known bands in the green, the existence of an absorption band ( $\lambda = 634$ ) in the red, with solutions of fresh blood in distilled water, and also with dilute aqueous solutions of various specimens of oxyhæmoglobin prepared from the blood of different animals. In the case of oxyhæmoglobin from the blood of the guinea-pig, the same absorption band was also shown by a preparation of the crystals. This absorption band appears to be identical with that generally associated with the presence of methæmoglobin, which has so far been supposed to occur only in blood which has undergone change. With preparations of blood suspended in isotonic solutions, only the two bands in the green were observed. It is possible, therefore, that the red absorption band becomes associated with the colouring matter only when it has escaped from the corpuscle.

T. A. H.

**Effect of Acids upon Blood.** C. E. HAM and HERMANN BALEAU (*J. Physiol.*, 1905, 32, 312—318).—In the conversion of oxyhæmoglobin into acid hæmatin by the action of acids, half the amount of replaceable oxygen, as obtained by the ferricyanide method, is liberated. Methæmoglobin is not an intermediate stage in the conversion. Other proteids can replace globin in the oxyhæmoglobin molecule. If ammonium sulphide is added to hæmin prepared by Schalféeff's method, hæmochromogen is formed; if globin or egg-white is added, hæmoglobin is regenerated. The action of acid is to resolve the combination between oxygen and globin, and to combine with the globin, forming acid albumin and liberating free oxygen. On this hypothesis, oxyhæmoglobin has the formula  $O \cdot Fe(C_{16}H_{15}ON_2)_2 \cdot O \cdot G$ , where G represents the globin group. The two oxygen atoms are linked to iron, but not in the same way, one being more firmly united. This is what one would expect from its chemical behaviour towards strong and weak acids.

W. D. H.

**Effect of Phosphorus on the Coagulation of Blood. Origin of Fibrinogen.** MAURICE DOYON, ALBERT MOREL, and N. KAREFF (*Compt. rend.*, 1905, 140, 800—801).—Poisoning by phosphorised oil produces in dogs fatty degeneration of the liver, the disappearance of fibrinogen from the blood-plasma, and incoagulability of the blood. In the cock, these effects do not occur. The loss in fibrinogen varies with the intensity of the fatty degeneration; the changes in the blood are secondary to those in the liver.

W. D. H.

**Reduction of Oxyhæmoglobin.** RAPHAEL LÉPINE and BOULUD (*Compt. rend.*, 1905, 140, 993—995).—Anæmia, anæsthetics, and microbial infections, especially with *Staphylococcus*, increase the time required for the reduction of the oxyhæmoglobin of the blood with ferrous sulphate to twice or thrice the normal. The observations were made on dogs and men.

W. D. H.

**Natural Nourishment of Infants.** MAX RUBNER and OTTO HEUBNER (*Chem. Centr.*, 1905, i, 1172; from *Zeit. exp. Path. Ther.*, 1, 1—25).—A metabolism research on a boy 5½ months old. On mother's milk (1.99 grams nitrogen, of which 1.63 was of proteid origin, 37.7 grams fat, and 80.5 lactose per diem), it put on daily, on the average, 0.46 gram of nitrogen. The carbon intake was insufficient, but in spite of this the child increased in weight at the rate of 83 grams a day, of which the nitrogen only accounted for 10 grams, allowing for the loss of carbon; water in the main accounted for the remainder. Of the total energy, the proteid in the diet accounted for 5 per cent. The small amount of proteid necessary is noteworthy. The child was extraordinarily active and cried much. Important conclusions are deduced concerning infants' diet, and nutrition in general. In different children, from 91 to 94 per cent. of mothers' milk is utilised.

W. D. H.

**Behaviour of Salt Solutions in the Stomach.** ERNST OTTO (*Chem. Centr.*, 1905, i, 1037; from *Arch. exp. Path. Pharm.*, 52, 370—388).—Whether the stomach plays the part of a protective organ against the introduction of saline solutions of varying strength into the intestine, was investigated on dogs with duodenal fistula. Its action in this direction is quite unimportant. In fact hypotonic or hypertonic solutions are never rendered isotonic, the solutions passing far too rapidly through the stomach.

W. D. H.

**Concentration of Hydrogen Ions in Pure Gastric Juice, and its Relation to Electrical Conductivity and Acidity. The Influence of the Alkaline Earths on the Reaction of Animal Fluids.** PAUL FRAENCKEL (*Chem. Centr.*, 1905, i, 1171; from *Zeit. exp. Path. Ther.*, 1, 431—438, 439—445).—The concentration of hydrogen ions in the gastric juice obtained from dogs by Pawloff's method is measured by the electrical method. It varies within comparatively narrow limits around 0.1N. It is raised by injection of pilocarpine. The amount of hydrochloric acid approaches that obtained by titration with Congo red as indicator. The juice always contains proteid. Examination of gastric juice from children led to the same results.

A small increase in hydrogen ions is produced by neutral salts of the alkaline earths.

W. D. H.

**Influence of Different Proteids, Asparagine, and Lecithin in Nitrogenous Metabolism.** W. VÖLTZ (*Pflüger's Archiv*, 1905, 107, 360—415, 415—425).—The nitrogen of paranuclein is better absorbed than that of serum albumin, but the latter substance leads to a greater putting on of nitrogen in the body. Asparagine is not

entirely absorbed, but some is found in the fæces; it is of little value in itself in producing an increase of proteid in the body. If it is given with paranuclein, the proteid metabolism is much increased; in the case of casein and asparagine, this is markedly so; the increase is less when asparagine is given with serum albumin. Proteid metabolism is favoured by the administration of lecithin; this is attributed to the phosphorised constituent of the molecule. In the same individual on the same diet, considerable variations in proteid metabolism are noticeable.

W. D. H.

**The Pancreas and Glycolysis.** RICHARD CLAUS and GUSTAV EMEDE (Beitr. chem. Physiol. Path., 1905, 6, 343—348. Compare Abstr., 1904, ii, 179).—A second polemical paper against Cohnheim.

W. D. H.

**Spleen and Pancreas. II.** OSCAR PRYM (*Pflüger's Archiv*, 1905, 107, 599—620).—The theory originated by Schiff and supported, among others, by Herzen and Bellamy, that the spleen forms some substance necessary for the transformation of the pancreatic trypsinogen into trypsin, receives no support from the present experiments carried out with infusions of the two organs. A favourable result on pancreatic activity does often follow admixture with spleen infusion, but this is no specific influence of the spleen; it is due to dilution and to bacterial activity, the boric acid used by Herzen as an antiseptic not being an efficient one.

W. D. H.

**Proteolytic Products of the Splenic Enzyme acting in an Alkaline Medium.** E. PROVAN CATHCART (*J. Physiol.*, 1905, 32, 299—304).—The proteolytic enzyme in the spleen (*lieno-β-protease*), which acts in an acid medium, has been investigated by Leathes (Abstr., 1902, ii, 615). The present research relates to *lieno-α-protease*, the enzyme active in an alkaline medium. The following products were isolated: histidine, inactive arginine, lysine, tyrosine, leucine, alanine, aminovaleric acid, pyrrolidine-2-carboxylic acid, glutamic acid, phenylalanine, and ammonia. Aspartic acid was probably also present. Tryptophan was not isolated, although there was a well-marked glyoxylic reaction. The main differences from what Leathes found are (1) the nature of the arginine (Leathes found the optically active variety); (2) the proportion of aspartic and glutamic acids (Leathes found more of the former).

W. D. H.

**Proteid Decomposition and Acidosis in Extreme Hunger.** THEODOR BRUGSCH (*Chem. Centr.*, 1905, i, 1173—1174; from *Zeit. exp. Path. Ther.*, 1, 419—430).—The observations were made on Succi, the fasting man. The fast lasted 31 days; during the last 10 days there were signs of acidosis. The urea output was lessened, that of ammonia increased; the urine contained considerable quantities of  $\beta$ -hydroxybutyric acid; this, with acetoacetic acid and acetone, is considered to originate from the fat of the body, for in a woman in a reduced condition owing to an œsophageal tumour, there was no trace of acidosis.



The purine substances tend to fall to a value below that found during a purine-free diet. The phosphoric acid excretion indicates that more muscular proteid and less bone substance disintegrate than in earlier researches and in other fasting men. W. D. H.

**Differences in Staining Reaction of Living and Dead Protoplasm.** VLADISLAV RŮŽIČKA (*Pflüger's Archiv*, 1905, 107, 497—534).—Mosso has introduced a differential stain for dead and living protoplasm, and Rhumbler uses the same reagent, methyl-green. In the present research, a mixture of neutral-red and methylene-blue is recommended, and full histological instructions are given for its use. As a result of numerous observations on various kinds of cells, animal and vegetable, it is proved that the staining with red is a sign of life, with the blue a sign of death. Some theoretical deductions concerning the nature of the reaction are entered into, the main outcome of which is that two different reducing groups exist in the protoplasm, but it is admitted that no complete explanation can be forthcoming until more is known of the chemistry of protoplasm. W. D. H.

**Basophil Granules in Nerve.** J. S. MACDONALD (*Proc. Physiol. Soc.*, 1905, xxxvii—xxxviii; *J. Physiol.*, 32).—In nerve fibres stained by "neutral red," minute, stained granules are thickly deposited in the vicinity of an injury, and coarse granules develop in the neighbouring portion of the axis cylinder at irregular intervals of its length, but at intervals of time proportional to the distances between the granules. In cooled frogs, these granules are yellow, and some disappear. In warmed frogs, they are red and more permanent. The cooled nerve fibre thus appears to be alkaline, the warmed acid. This may be interpreted as (1) distinction between active and resting nerve; but attempts to change the reaction by stimulation have failed; (2) as due to the different reaction of the muscles from among which the nerve was removed; or (3) as due to a change in the partition of acids and bases owing to the difference in temperature. The granules are either a precipitation of the dye, stained coagula of proteid, or a combination of the two. The appearances are similar to those depicted by Macallum in his microchemical test for potassium salts (this vol., ii, 270). By his method, potassium salts may be detected wherever the axis cylinder is injured, which otherwise escape detection. At an injured spot, the axis cylinder seems to separate into a central coagulated albuminous core, and an outer solution of salts. The injury current can only be explained as a consequence of diffusion at the site of injury; this could be reduced, balanced, or reversed by alterations in the medium into which diffusion occurs; but the solutions necessary to balance the injury were found to be so extraordinarily concentrated as to diminish the trust to be placed on the significance of the fact. The microscopical evidence now adduced shows that a salt solution of great concentration is found at the injured spot. Should such evidence bear critical examination, important conclusions may be drawn as to the chemical constitution of the axis cylinder. W. D. H.

**Alcohol and Acetone in the Tissues and Fluids of the Body.** F. MAIGNON (*Compt. rend.*, 1905, 140, 1063—1065, 1124—1126).—Small quantities of alcohol and acetone were found in all the tissues and in the blood and urine. These are produced during life. They are oxidised with the formation first of acetic acid, and finally carbon dioxide and water. They are considered to originate from dextrose.

W. D. H.

**Acetone-formation in the Body. II.** GIUSEPPE SATTÀ (*Beitr. chem. Physiol. Path.*, 1905, 6, 376—391).—The research relates to substances which act inhibitably on acetone formation; they were found to be galactose, lævulose, glycerol, tartaric acid, lactic acid, and citric acid; malonic acid does not act in this way. A discussion on the explanation of these results follows. Acetone-formation is believed to occur in the organs not in the alimentary tract.

W. D. H.

**Variations in Dextrose, Glycogen, Fat, and Albumin in the Course of the Metamorphoses in the Silk-worm.** C. VANEY and F. MAIGNON (*Compt. rend.*, 1905, 140, 1192—1195).—The variations in sugar, glycogen, fat, and albumin in the course of the metamorphoses of the silk-worm are given; for instance, during silk formation there is a great increase in albumin and glycogen.

W. D. H.

**Animal Lactase.** H. BIERRY (*Compt. rend.*, 1905, 140, 1122. Compare Abstr., 1904, i, 840).—Negative attempts to confirm the conclusions of Weinland (Abstr., 1900, ii, 93; 1901, ii, 30) and of Bainbridge (Abstr., 1904, ii, 424).

W. D. H.

**Philo-catalase and Anti-catalase in Animal Tissues.** FR. BATTELLI and MLE. L. STERN (*Compt. rend.*, 1905, 140, 1197—1198. Compare Abstr., 1904, ii, 499).—Anti-catalase is the name given to a "ferment" capable of destroying catalase in the presence of oxygen. It occurs in many tissues, such as spleen, liver, and lung. In several tissues and in the blood serum there exists still another substance having the properties of a ferment and possessing the power of destroying anti-catalase, thus protecting catalase; it is named philo-catalase.

W. D. H.

**Acid Dyscrasia.** ALEXANDRE DESGREZ and MLE. BL. GUENDE (*Compt. rend.*, 1905, 140, 882—884. Compare Abstr., 1904, ii, 193).—From experiments on guinea-pigs, in which the urine was examined after administration of various aromatic acids, the following conclusions are drawn. The elaboration of proteid matter is diminished under the influence of the dyscrasia produced by phenylpropionic acid and its analogues. This occurs under the influence both of the saturated acids and of acids containing an acetylenic linking. The amount of phosphoric acid in the urine indicates a preponderating destruction of the phosphorised proteids in cellular nuclei. When the molecule has not all its carbon atoms saturated, the result differs according as one uses an ethylenic or acetylenic union. The double union in cinnamic acid

exercises a favourable influence, hindering the destruction produced by the carboxylic compound, probably by giving origin to ethylenic oxide in the metabolic process. The cells of the organism preserve for a considerable time the new vital modality impressed on them by acid dyscrasia.

W. D. H.

**The Distribution of Nitrogen in the Urine.** GIUSEPPE SATTA (*Beitr. chem. Physiol. Path.*, 1905, 6, 358—375).—In normal individuals taking no carbohydrate, the ammonia and purine nitrogen is increased at the expense of the other substances which are precipitable by phosphotungstic acid. In diabetes, there is always an increase in the monoamino-acid fraction; ammonia is increased, whilst the urea is correspondingly diminished. In a dog without a pancreas, the urea excretion remains normal, but the monoamino-acids increase.

W. D. H.

**Precipitins and Anti-precipitins.** P. BERMBACH (*Pflüger's Archiv*, 1905, 107, 621—625, 626—629).—A number of observations are given regarding the amount of serum containing precipitin which is necessary to cause precipitation in various normal sera, but it is admitted that the observations are too scanty for the drawing of general conclusions, except that evidence exists for the presence in some circumstances of inhibitory materials or anti-precipitins.

W. D. H.

**Toxins and Anti-toxins.** I. THORVALD MADSEN and L. WALBUM. II and III. THORVALD MADSEN and HIDEYO NOGUCHI. IV. THORVALD MADSEN (*Chem. Centr.*, 1905, i, 1264—1266; from *Bull. Acad. Sci. Lettres Danemark*, 1904, 425—446, 447—456, 457—464; 1905, 1—10).—I and II. *Influence of Temperature on the Reaction Velocity.*—Arrhenius' formula for the influence of temperature on reaction velocity does not hold for the hæmolysis produced by alkalis; the constant diminishes with time, and at low temperatures = 0. The law, however, holds for various forms of agglutination, in certain cases with some variations for the action of acids on red corpuscles, but not for the action of lecithin.

III. *Saponin-cholesterol.*—The action of saponin on the corpuscles is believed to depend on the combination it forms with cholesterol; this is borne out by an examination of the dissociation curve of the compound.

IV. *The Poison of Botulism and its Antitoxin.*—As in some other cases where there is no direct relation between quantity and action, the neutralisation point is difficult to determine.

W. D. H.

**Action of Calcium Permanganate on Tetanic and Diphtheritic Toxins and on Tuberculin.** J. BAUDRAN (*Compt. rend.*, 1905, 140, 884—886).—Calcium permanganate not only destroys the toxicity of alkaloids such as strychnine, but also that of tetanus toxin, diphtheria toxin, and tuberculin. The products obtained all contain calcium and manganese.

W. D. H.



**Absorption of Chloroform in Later Stages of Anæsthesia.**

BERTRAM J. COLLINGWOOD (*Proc. Physiol. Soc.*, 1905, xxviii—xxx; *J. Physiol.*, 32).—In the early stages of anæsthesia, large amounts of chloroform are absorbed. After a long period of anæsthesia, the dosage of the drug being kept constant, the amount absorbed is not great. When the organism is fully saturated with the narcotic, a very low percentage is necessary to maintain anæsthesia. The numbers given relate to cats. An improved form of tonometer for the estimation of chloroform is figured and described. W. D. H.

**Poisonous Symptoms in Dogs with Eck's Fistula.** C. J.

ROTHBERGER and HEINRICH WINTERBERG (*Chem. Centr.*, 1905, i, 1175; from *Zeit. exp. Path. Ther.*, 1, 312—359).—The workers of the St. Petersburg school state that dogs with an Eck's fistula exhibit toxic signs when meat, carbamic acid, ammonia, and glycine are given. In the present research, no such results were obtained; the dogs stand a meat diet well. They are easily poisoned by strychnine given by the mouth or subcutaneously, but are more resistant to tolylenediamine than normal dogs, thus resembling dogs in which the spleen has been extirpated. W. D. H.

**Chemistry of Malignant Growths. III. Nucleo-histon as a Constituent of Tumours.** S. P. BEEBE (*Amer. J. Physiol.*, 1905, 13, 341—349).

—A good method of separating nucleo-histon from nucleo-proteid is that of Huiskamp and Bang, who precipitate the former in neutral solutions by calcium chloride. Bang obtained no nucleo-histon from five fibro-sarcomas, but in a sixth case obtained a substance from a sarcoma of the testis with the characters of lymph-gland nucleo-histon. Nucleo-histon was not found in normal testis. In the present research, fourteen tumours were examined, but the only undoubted cases in which nucleo-histon was found were in the lymph-glands. A difficulty of the investigation is the occurrence of degenerations in tumours, and nucleo-histon is easily changed by autolysis into a condition which gives no precipitate with calcium chloride. The general conclusion drawn is that nucleo-histon is not a common constituent of tumours. Neuberg's work on the occurrence of pentose in cancer is regarded as important and suggestive. W. D. H.

**Action of Formic Acid on Tremors.** E. CLÉMENT (*Compt. rend.*, 1905, 140, 1198—1199. Compare Abstr., 1904, ii, 430).

—The increase of muscular tonus said to be the result of the administration of formic acid led to its being given for tremors. It was given to a woman aged sixty-five who had trembled for ten years, and to a man aged seventy-two who had trembled for eighteen years. The result was amelioration of the condition. W. D. H.

**Treatment of Trypanosomiasis.** A. LAVERAN (*Compt. rend.*, 1905, 140, 1081—1084. Compare this vol., ii, 272).—Further details are given of the treatment of *Trypanosoma gambiense* infections by arsenious acid and trypan-red. The present research gives an account of two monkeys cured by this method. They had been infected with

the parasite from a case of sleeping sickness. Three or four alternate doses, with 8 or 10 days' intervals, of arsenious acid injected subcutaneously or intravenously, and trypan-red given in sufficient quantity to redden the skin and the excretions, are sufficient. W. D. H.

**Behaviour of Iodoform in the Body.** PAUL MULZER (*Chem. Centr.*, 1905, i, 1174—1175; from *Zeit. exp. Path. Ther.*, 1, 446—479).—Iodoform was given by an œsophageal sound to rabbits. The iodine mainly reappears in the urine as alkali iodide and iodate; this excretion lasts for 6 or 7 days; the fæces contain only traces. About 60 per cent. of the iodine is thus found. Iodoform as such passes neither into the urine nor the expired air. Iodine is found also in the sweat and hair. The lethal dose is 1—2 grams per rabbit. It acts as a narcotic in dogs but not in rabbits. The toxic symptoms are respiratory with convulsions and paralysis; the reflexes are diminished, and towards the end the temperature sinks rapidly. Fatty degeneration is the most marked post-mortem sign. W. D. H.

**Pharmacology of Ethyl Salicylate.** ELIJAH M. HOUGHTON (*Amer. J. Physiol.*, 1905, 13, 331—340).—Ethyl salicylate is a colourless, volatile, slightly soluble, oily liquid with a pleasant characteristic odour and taste. It is not an antiseptic. It has little or no local irritant action. It is quickly absorbed from the stomach or subcutaneously and is rapidly excreted by the kidneys. It stimulates certain nerve centres, producing in large doses frequent respiration and a lowering of blood-pressure and cardiac activity. If pushed, the animal dies from paralysis of the respiratory centre and diastolic standstill of the heart; this is due to the direct action of the drug on the muscular tissue. Compared to the methyl compound, it is less toxic and produces less intestinal irritation. W. D. H.

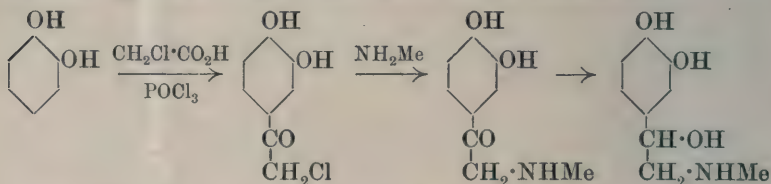
**Sense of Taste in Pharmacy and Pharmacology.** WILHELM STERNBERG (*Chem. Centr.*, 1905, i, 1042; from *Ber. deut. Pharm. Ges.*, 15, 36—45).—The effect of chemical composition on taste has been investigated in the case of several drugs, but more especially for "dulcin" and its homologues.  $p$ -Phenetolecarbamide,  $\text{OEt}\cdot\text{C}_6\text{H}_4\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$ ,  $p$ -anisolecarbamide,  $\text{OMe}\cdot\text{C}_6\text{H}_4\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$ , the compound,  $\text{C}_6\text{H}_4\text{Me}\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$ , and  $as$ -dimethylcarbamide,  $\text{NMe}_2\cdot\text{CO}\cdot\text{NH}_2$ , have a sweet taste; but  $s$ -dimethylcarbamide,  $\text{CO}(\text{NHMe})_2$ , and  $s$ - $p$ -diphenetolecarbamide,  $\text{CO}(\text{NH}\cdot\text{C}_6\text{H}_4\cdot\text{OEt})_2$ , are tasteless. Similarly, carbamido- $p$ -phenoxyacetic acid,  $\text{CO}_2\text{H}\cdot\text{CH}_2\cdot\text{O}\cdot\text{C}_6\text{H}_4\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$ , is without taste, but the ammonium salt of tolylenedioxamic acid,  $\text{C}_6\text{H}_4\text{Me}(\text{NH}\cdot\text{CO}\cdot\text{CO}_2\text{H})_2$ , is intensely sweet. E. W. W.

**Action of Camphor on the Circulation.** E. SELIGMANN (*Chem. Centr.*, 1905, i, 1039; from *Arch. exp. Path. Pharm.*, 52, 333—345).—Camphor in certain circumstances strengthens the heart-beat, and induces regular beats in a surviving heart which exhibits fibrillary contractions. No certain action on the vaso-motor mechanism could be determined. W. D. H.

**Action of Camphor on the Frog's Heart poisoned with Chloral Hydrate.** A. BÖHME (*Chem. Centr.*, 1905, i, 1039—1040; from *Arch. exp. Path. Pharm.*, 52, 346—369).—A frog's heart, rendered slow-beating or even quiescent with chloral hydrate, is rendered more active with camphor. Its use as a cardiac stimulant is recommended.

W. D. H.

**Physiological Action of Synthetical Substances allied to Adrenaline.** HENRY D. DAKIN (*Proc. Physiol. Soc.*, 1905, xxxiv—xxxvi; *J. Physiol.*, 32. Compare *Proc.*, 1905, 21, 154).—Starting from catechol, it is possible to prepare a base with properties similar to those of adrenaline. The stages are given in the following formulæ, the details being reserved for a later communication :



The formula of the final product, which is Jowett's for adrenaline, is given provisionally, for there are certain differences between the new base and adrenaline; for instance, the synthetical base is optically inactive; its salts, however, show all the reactions of those of adrenaline, and its physiological activity is as great; less than a millionth of a gram will raise the blood-pressure. The intermediate ketone (Friedmann's adrenalone) is not much more powerful physiologically than the chloroacetyl catechol from which it is prepared.

A number of allied substances have been prepared which may be grouped chemically as follows :

I. The simplest member of the series  $\text{C}_6\text{H}_3(\text{OH})_2\cdot\text{CO}\cdot\text{CH}_2\cdot\text{NH}_2$ .

II. Derivatives of the type  $\text{C}_6\text{H}_3(\text{OH})_2\cdot\text{CO}\cdot\text{CH}_2\cdot\text{NHR}$ .

(a) Where R is an aliphatic group.

(b) Where R is a mixed group, like benzyl.

(c) Where R is aromatic, like phenyl.

III. Derivatives of the type  $\text{C}_6\text{H}_3(\text{OH})_2\cdot\text{CO}\cdot\text{CH}_2\cdot\text{NR}_2$ .

IV. Derivatives of the type  $\text{C}_6\text{H}_3(\text{OH})_2\cdot\text{CO}\cdot\text{CH}_2\cdot\text{NR}_3\cdot\text{OH}$ .

Substances in classes I and IIa produce a marked rise of blood-pressure in doses of about 1 mg. per kilo. of body-weight, and on reduction yield bases with the activity approximately of adrenaline.

Class IIb stands both chemically and physiologically between these and those in class IIc. The latter cause fall of pressure, which may be followed by a slight rise. The di-alkyl bases (Class III) have a smaller action than those in class IIa; their reduction products, however, are very active. Only two members of class IV have been examined, the trimethyl compound, which is very active, and the phenyldimethyl compound, which is inactive.

Catechol itself, in doses of 2 mg. per kilo., causes a distinct rise in blood-pressure; the same is true for many of its simple derivatives and homologues, for instance, protocathechuic acid, pyrogallol, &c.



Substances in which the hydrogen of the phenol groups is replaced are inactive.  
W. D. H.

**Corydalis Alkaloids.** JOHANNES GADAMER (*Arch. Pharm.*, 1905, 243, 147—154).—The physiological action of these alkaloids has been studied by Hans Meyer and Peters (Peters, *Inaug. Diss.*, Marburg, 1904). With the exception of corytuberine, they all produce, in frogs, a narcosis like that brought about by morphine, and have a prejudicial effect on the action of the heart. It is possible that bulbocapnine may find an application as a narcotic in vivisection and in veterinary practice, in the case of animals which are stimulated by morphine. In other respects, the alkaloids in question fall into three groups corresponding with their chemical differences (Abstr., 1902, i, 307); those of the corydaline group produce paralysis of the spinal cord; those of the corycavine group stimulate the motor centres; and those of the bulbocapnine group cause an increased reflex action, at any rate in frogs.  
C. F. B.

**Fibrin Ferments in Snake Venom.** CHARLES J. MARTIN (*J. Physiol.*, 1905, 32, 207—215).—The venom of various snakes produces clotting in oxalate plasma, citrate plasma, fluoride plasma, magnesium sulphate plasma, hydrocele fluid, and solutions of fibrinogen. Hence the venom contains actual fibrin ferment; the ferment is not used up in the process, but the serum after clotting is still active in promoting coagulation; the ferment, however, if this is repeated often, gradually disappears from adsorption by the successive crops of fibrin. The small quantity of venom necessary to cause clotting is remarkable; the figures given show that this varies in different snake-venoms. The ferment is destroyed at 75°, and dialyses slightly. The ferments, however, are not identical. The serum of a horse immunised against one venom contains an anti-ferment against the clotting ferment in that venom, but not necessarily in other venoms. A very simple time-relationship was found in investigating the velocity of reaction, namely, that amount of ferment and coagulation tissue are inversely proportional.  
W. D. H.

**Spear Poison of the Cameroons.** LUDWIG BRIEGER and M. KRAUSE (*Chem. Centr.*, 1905, i, 1171—1172; from *Zeit. exp. Path. Ther.*, 1, 93—97).—The spears used in elephant hunting are covered with a poison obtained from the wood of a *Strophanthus*-like tree by trituration. Fifty grams of the raw material yielded about 4 grams of a pure crystalline poison. This is a heart poison, resembling digitalin, and appears to be identical with strophantin.  
W. D. H.

**The Munchi-arrow Poison.** ALFRED FRÖHLICH (*J. Physiol.*, 1905, 32, 319—326).—The poison was obtained from arrows from Northern Nigeria. The toxic principle belongs probably to the class of resinous acids. No alkaloid reaction could be obtained, no crystals formed, and the poison, unlike nearly all alkaloids, was insoluble in water. The symptoms are mainly paralytic, the heart being affected before the

skeletal muscles. *Rigor mortis* sets in early. This points to an action of the poison on the muscle proteids, but the attempts made to determine the nature of the alteration gave no positive results.

W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Décomposition of Calcium Cyanamide.** F. LÖHNIS (*Centr. Bakt. Par.*, 1905, ii, 14, 389—400).—Experiments with twelve micro-organisms showed that nearly all of them, especially *Bacterium Kirchneri*, *B. lipsiense*, *Bacillus megatherium*, and *B. vulgare* var. *Zopfii*, liberate ammonia from calcium cyanamide at the ordinary temperature. Aëration had no essential effect on the process. Of the various organisms employed, only *B. Kirchneri* has the power of producing ammonia from urea.

*Urobacillus Leubei* and *Planosarcina ureæ* both liberate ammonia from calcium cyanamide; *Urobacillus Pasteuri* had very little effect.

N. H. J. M.

**Influence of Different Sugar Solutions on the Temperatures at which Various Yeasts are killed.** F. W. TULLO (*Chem. Centr.*, 1905, i, 1176—1177; from *Woch. Brauerei*, 22, 155—160).—The temperature at which yeast is killed was found to be 55° (for 5 minutes) in solutions of dextrose, lævulose, galactose, rhamnose, maltose, lactose, and sucrose, and in water alone. In experiments made somewhat below the maximum temperature, it was found that when heated for a long time, fermentable sugars are on the whole more unfavourable than non-fermentable sugars and water alone.

N. H. J. M.

**Heliotropism indirectly caused by Radium.** HANS MOLISCH (*Chem. Centr.*, 1905, i, 1033—1034; from *Ber. deut. bot. Ges.*, 23, 2—8. Compare Dixon and Wigham, *Sci. Proc. Roy. Dublin Soc.*, 10, ii, No. 19, and Koernicke, *Ber. deut. bot. Ges.*, 22, 155).—Experiments on various plants have shown that although a radium preparation alone does not cause heliotropism, a mixture of a radium salt with zinc blende is very active in this respect. The effect must therefore be due to the light emitted by the phosphorescent blende and not to the radium rays. The seedlings require to be placed within 2—3 cm. of the tube containing the blende. The fact that whilst the experiments with lentils, peas, and vetches succeeded in the laboratory, similar experiments in a forcing house failed, is attributed to the presence of traces of coal gas and other impurities in the air of the former. These traces of poison affect the sensitiveness of the plant in such a way that the effect of gravity is modified or counteracted whilst the sensitiveness of the plant to light is not affected.

E. W. W.

**Desiccation of Plants and Vegetable Tissues.** MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1905, [viii], 4, 488—490, 490—505, 506—519, 520—538, 538—552).—This series of papers gives in greater detail results already published (this vol., ii, 50—51, 111).

T. A. H.

**Influence of Different Amounts of Soil on the Development of Plants.** OTTO LEMMERMANN (*J. Landw.*, 1905, 53, 173—177. Compare Abstr., 1904, ii, 76).—The conclusion is drawn that it is not the space at the disposal of plants grown in pots which causes diminished growth, but the nutritive conditions due to the volume of soil, the amount of water being frequently the most important factor.

N. H. J. M.

**Effects of Ammonium Salts on the Assimilation of Phosphoric Acid by Higher Plants.** DMITRI N. PRIANISCHNIKOFF (*Chem. Centr.*, 1905, i, 1045; from *Ber. deut. bot. Ges.*, 22, 8—17. Compare Abstr., 1902, ii, 169).—Substitution of sodium nitrate for calcium nitrate increased the alkalinity at the end of the experiment and in some cases (buckwheat) diminished the yield. With ammonium nitrate, the reaction was neutral; with ammonium sulphate, distinctly acid. The action of crude phosphates is increased by ammonium nitrate, but diminished by ammonium sulphate.

N. H. J. M.

**Composition of Lemon Juice.** ADOLF BEYTHIEN and PAUL BOHRISCH (*Zeit. Nahr. Genussm.*, 1905, 9, 449—464).—The results of the analyses of about 70 samples of lemon juice are given in tabular form, the quantities of extract, citric acid, invert sugar, ash, alkalinity of ash, nitrogen, phosphoric acid, and alcohol in the various juices being recorded.

W. P. S.

**The Exudation of Resins.** ALEXANDER TSCHIRCH (*Arch. Pharm.*, 1905, 243, 81—98. Compare Moeller, *Zeit. allg. österr. Apoth.-Ver.*, 1896, 34).—By wounding a number of trees, both gymnosperms and angiosperms, it has been shown that the primary exudation of resin from secretory vessels, when such are present, is never large in amount; to this source, mastic, sandarac, and Strasburg turpentine are due. After a while, a much more copious secondary exudation sets in, and lasts for some time, until the wound is closed over. Under the stimulus of the wound, a formation of pathological new wood takes place, and it is in this that the resin canals are formed.

C. F. B.

**Arrow Poison of the Lukarets.** A. SAPIN (*J. Pharm. Chim.*, 1905, [vi], 397—398).—The dried poison contains 47 per cent. of a pure resin, 41 per cent. of vegetable debris, and 12 per cent. of ash. It appears to be the sap of *Euphorbium*.

G. D. L.

**Seedling Diseases of Sugar-beet and Mangolds.** LORENZ HILTNER and L. PETERS (*Chem. Centr.*, 1905, i, 1043—1044; from *Arb. biol. Abt. k. Ges. Amt.*, iv, 3; and *Zeit. Ver. Rübenzuckerind.*, 1905, 165—169).—In pot experiments, it was found that treatment with



copper, calcium, and mercuric chloride preparations was suitable in the case of unhealthy soils, but not much effect was observed in field experiments. In view of the importance of oxalates and similar compounds in connection with the occurrence of disease, it seems probable that treatment of the seed with calcium carbonate may be of use.

N. H. J. M.

**Deli Tobacco.** D. J. HISSINK (*J. Landw.*, 1905, 53, 135—172).—Results of manurial experiments with tobacco made at Deli (Sumatra). Analyses of the ash and determinations of the nitrogen in different forms are given.

N. H. J. M.

**Feeding with Calcium Phosphate.** MAX PASSON (*J. Landw.*, 1905, 53, 115—134. Compare Abstr., 1903, ii, 240, and this vol., ii, 265).—Addition of calcium phosphate to food is desirable in the case of potatoes and other foods poor in calcium phosphate and acid foods, or foods having an acid ash.

Feeding cows with calcium phosphate results in milk somewhat richer in phosphoric acid, and therefore better for calves. When given to cows about to calve, it has no effect on the bone development of the calf.

Deficiency of calcium phosphate in fodder may occur in dry summers when the plants may be unable to take up sufficient phosphoric acid from the soil. In such cases, calcium phosphate should be added in good time to the food. Precipitated calcium phosphate is the most suitable preparation. Other earthy phosphates are unsuitable.

N. H. J. M.

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## Analytical Chemistry.

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**The Question of Uniform Standardising Substances for Volumetric Solutions.** S. P. L. SÖRENSEN (*Zeit. anal. Chem.*, 1905, 44, 141—155).—This question has been the subject of discussion at the last three International Congresses for Applied Chemistry, with the special object of establishing normal methods to be adopted in disputable cases. The opinions expressed on this matter have been extremely discordant. The author directs attention to the difference between the selection of an appropriate substance for a standard, which choice has only to be made once for all, and the examination of the particular specimen of that substance, as regards its purity, and especially its freedom from adventitious moisture, which has to be undertaken every time it is employed. He rejects entirely the view put forward by Wagner that the attainment of concordant results when using two or more standardising substances for the same solution is a proof of the correctness of those results, and depends rather on the careful qualitative examination of the selected substance in circumstances which ensure a certainty as to the quantitative limit to

the sensitiveness of the tests, and he insists on the necessity of these tests being of sufficient delicacy to render negligible any errors which might result from their failure to detect impurities. M. J. S.

**Use of Sodium Carbonate and Sodium Oxalate as the Standard Substances in Acidimetry.** S. P. L. SÖRENSEN and A. C. ANDERSEN (*Zeit. anal. Chem.*, 1905, 44, 156—184).—In the course of researches undertaken for the 5th International Congress for Applied Chemistry, Lunge concluded that sodium carbonate is to be preferred to all other substances for standardising an acid. Whilst placing second in order of merit the author's special anhydrous sodium oxalate (*Abstr.*, 1903, ii, 684, 750), which he found to give results 1 per mille higher than those with the carbonate, he rejects it on account of the greater skill requisite for its use. The authors show that, provided the oxalate is decomposed by the heat of a spirit flame (to exclude sulphur), no special care is necessary to obtain absolutely concordant results. They find that at no temperature is it possible to dry sodium carbonate completely without a loss of carbon dioxide, but that provided the amount of sodium hydroxide in a sample is estimated, and the corresponding loss of weight allowed for, the results agree with those given by the oxalate much more closely than was found by Lunge. Since Lunge preferred methyl-orange to phenolphthalein, the author has instituted a special comparison of the results yielded by the two indicators, and finds that in a solution feebly acid to phenolphthalein and free from carbonic acid, methyl-orange gives a yellow colour, and that a noteworthy addition of acid is necessary to obtain the transition tint, but that if, instead of adding acid, the yellow solution is saturated with carbon dioxide, the colour changes to a bright red, and an addition of alkali is required to produce the transition tint. Methyl-orange, therefore, does not in any case give the same result as phenolphthalein, and since it is not indifferent to carbonic acid its use presents no advantages where accurate work is wanted.

M. J. S.

**Sodium Hydrogen Carbonate in Iodometry.** WILLIAM A. PUCKNER (*Chem. Centr.*, 1905, i, 1186—1187; from *Amer. Pharm. Gesell.*, 1905, 1—9).—The author calls attention to the fact that under certain conditions iodine acts on sodium hydrogen carbonate and that in consequence an error may be introduced into iodometric analyses.

If, however, the solution contains less than 1 gram of sodium hydrogen carbonate in 100 c.c. and is also charged with carbon dioxide, no iodine will be absorbed.

L. DE K.

**Detection of Hydrogen Peroxide in Milk.** FRANZ UTZ (*Milchw. Zentr.*, 1905, 1, 175—178).—Hydrogen peroxide can be detected in milk which has been boiled before being preserved for a much longer time than in raw milk, the enzymes in the latter quickly destroying the peroxide. Temperature also has a considerable influence on the rapidity of the disappearance of the hydrogen peroxide. Milk containing 2 per cent. of a 3 per cent. hydrogen peroxide solution, after being kept at a temperature of 12—15° for 4 hours, still gives a strong

reaction with the titanous and vanadic acid tests (Abstr., 1903, ii, 449), whilst milk containing the same quantity of peroxide, when kept at a temperature of  $37.5^{\circ}$ , ceases to give a reaction after 3 hours.

W. P. S.

**Neumann's Method of estimating Chlorides.** W. LEGGE SYMES (*J. Physiol.*, 1905, 32, 221—224).—With some modifications, Neumann's method is found to be convenient and accurate when direct titration is difficult, as in the blood. With appropriate adjustment of the acid mixture, neither hydrocyanic nor nitrous acid is found in the distillate. The distillate, being colourless, can be titrated directly.

W. D. H.

**Estimation of Perchlorates and Chlorates in Saltpetre.** D. TSCHERNOBÉEFF (*Chem. Zeit.*, 1905, 29, 442—443).—A favourable criticism of Lemaitre's process for the estimation of perchlorates in nitre (Abstr., 1904, ii, 587) and also of Hendrixson's process for the estimation of chlorates in the presence of perchlorates (Abstr., 1904, ii, 679).

L. DE K.

**Reduction of Chlorates, Bromates, and Iodates with a view to the Estimation of the Halogens.** PAUL JANNASCH and A. JAHN (*Ber.*, 1905, 38, 1576—1589. Compare Schlötter, Abstr., 1904, ii, 146, 167; Roberto and Roncali, Abstr., 1904, ii, 773).—Details are given of the estimation of chlorine, bromine, and iodine in chlorates, bromates, and iodates by reduction with various reagents and precipitation with silver nitrate. Potassium chlorate and bromate are reduced quantitatively by concentrated nitric acid at  $275^{\circ}$  under pressure, by fuming nitric acid at the laboratory temperature or under cooling, or by hydrogen peroxide in dilute nitric acid solution. The iodate must be heated with fuming nitric acid and silver nitrate under pressure at  $340^{\circ}$ . Potassium bromate and iodate are reduced by formic acid or by hydrazine sulphate in alkaline solution; in acid solution, the latter reagent forms azoimide. Potassium chlorate is reduced when heated with dextrose and acetic acid at  $200^{\circ}$  under pressure, but only incompletely by acetaldehyde. Hydroxylamine sulphate or acetate is the most convenient reagent for the quantitative reduction of chlorates in dilute nitric acid, or of bromates or iodates in alkaline solution.

G. Y.

**Detection of Bromine in the presence of much Iodine.** H. CORMIMBEUF (*Ann. Chim. anal.*, 1905, 10, 145—146).—Soluble iodides, after having been neutralised if necessary, are mixed with excess of ferric chloride, which precipitates the iodine as a black powder, which is then removed by filtration. The little iodine still in solution is boiled off and the iron is precipitated by aqueous sodium hydroxide. The filtrate is carefully neutralised with dilute sulphuric acid, a crystal of potassium chlorate and a little chloroform are added, and then a few drops of strong sulphuric acid. This liberates any bromine, which dissolves with its characteristic colour in the chloroform. Free iodine is first converted into an iodide by digestion with water and an excess of reduced iron.

L. DE K.



**Free Iodine in Alkaline Solutions.** CHARLES M. VAN DEVENTER (*Chem. Centr.*, 1905, i, 990; from *Chem. Weekblad*, 2, 135—137. Compare Péchard, *Abstr.*, 1899, ii, 593).—The quantity of free iodine in alkaline liquors has been determined by comparing the colour imparted to chloroform with that similarly obtained from a known quantity of iodine dissolved in a solution of potassium iodide. When a solution of 0.32 mg. of iodine and 1 gram of potassium iodide is shaken with 12 c.c. of chloroform, the latter is just perceptibly coloured. Péchard's minimum has been found to be much too high; 0.5 gram of iodine dissolved in a solution of 0.4 of potassium hydroxide in 12 c.c. contained about 1 mg. of free iodine. E. W. W.

**Iodic Acid as an Oxidising Reagent.** ERWIN RUPP (*Arch. Pharm.*, 1905, 243, [ii]. 98—104).—The author has attempted to utilise the energetic oxidising power of iodic acid for the volumetric estimation of arsenious acid and potassium thiocyanate. The iodine liberated on adding a mixture of potassium iodate and sulphuric acid was expelled by warming, and the amount of unaltered iodic acid estimated as usual. Owing, however, to secondary reactions, the results were a failure.

In the case of formic acid, no secondary reactions occur. The action is, however, very slow, and must be assisted by heating for some time on the water-bath in a closed flask. L. DE K.

**Separation of Hydrofluoric and Sulphuric Acids.** RICHARD EHRENFELD (*Chem. Zeit.*, 1905, 29, 440—442).—The method is briefly as follows. The two acids are converted as usual into barium salts and weighed. The mixture is then treated for an hour with a standard solution of calcium dichromate and some hydrochloric acid; this dissolves the fluoride and leaves the sulphate, which may then be weighed by way of control. The filtrate is rendered ammoniacal, which causes a separation of barium chromate, and the excess of chromate is then estimated iodometrically. The difference in chromate represents the barium fluoride. L. DE K.

**Preparation of Standard Solutions of Sulphuric Acid.** BARKER NORTH and W. BLAKEY (*J. Soc. Chem. Ind.*, 1905, 24, 395—397).—For standardising solutions of sulphuric acid, the authors use pure sodium hydrogen carbonate. The latter is prepared by washing ordinary sodium hydrogen carbonate with water until free from chlorides. It is then dried on porous plates at the ordinary temperature, and afterwards powdered and placed in a moist atmosphere of carbon dioxide for several hours. When free from normal carbonate, the salt is dried over sulphuric acid or in a vacuum over phosphoric oxide. Normal carbonate cannot be detected in the dry product. The use of sodium hydrogen carbonate thus prepared gives results closely agreeing with those obtained by the gravimetric (barium sulphate) method, but about 2 per cent. higher than the results yielded by Marshall's method of determining the strength of the acid from its specific gravity. W. P. S.

**Volumetric Estimation of Ammonium Salts with Sodium Hypobromite.** ERWIN RUPP and E. RÖSSLER (*Arch. Pharm.*, 1905, 243, 104—114).—According to Mohr, the indirect titration of ammonium salts with sodium hypobromite gives untrustworthy results. The authors state that it is quite possible to obtain correct results by avoiding excess of alkali. They operate as follows: about 0.05 gram of the ammonium salt, dissolved in 10 c.c. of water, is slowly poured into a hypobromite solution diluted to 50—70 c.c. The amount of hypobromite should be such that about one-half or one-third should remain undecomposed. After 5—10 minutes, another 50 c.c. of water are added, then a sufficiency of dilute hydrochloric acid, and then at once potassium iodide. After two minutes, the liberated iodine is titrated with starch as indicator. In a successful test, the titrated liquid should not turn blue again for a few minutes. When dealing with free ammonia, this should be carefully neutralised.

The bromine solution must be made by dissolving 10 grams of sodium hydroxide in 500 c.c. of water and adding 17 grams of bromine. It must be standardised in the usual way with potassium iodide and is fairly permanent.

L. DE K.

**Gravimetric Estimation of Nitric Acid by means of Nitron [1:4-Diphenyl-3:5-endoanilodihydrotriazole].** ALEXANDER GUTBIER (*Zeit. angew. Chem.*, 1905, 18, 494—499).—An investigation of Busch's "nitron" process (this vol., i, 307; ii, 282). Eighty c.c. of the nitrate solution containing about 0.15 gram of the nitrate are mixed with 12 drops of dilute sulphuric acid and heated to boiling, when 12—15 c.c. of a 10 per cent. solution of nitron in 5 per cent. acetic acid are added. When cold, the beaker is placed in iced water, and after an hour the precipitate is collected at the pump on a weighed Neubauer platinum crucible, and then washed with 10 c.c. of water, using 1 c.c. at a time. After drying at 105—110°, the precipitate is weighed. One part of nitron-nitrate = 0.1653 part of  $\text{NO}_3$ . The process is recommended for the assay of commercial nitrates.

L. DE K.

**Estimation of Nitric Acid in Water.** MAX BUSCH (*Zeit. Nahr. Genussm.*, 1905, 9, 464—468).—One hundred c.c. of the water are heated nearly to boiling, and 10 drops of dilute sulphuric acid and 10—12 c.c. of 10 per cent. "nitron" acetate (*Abstr.*, 1905, ii, 282) solution are added. The mixture is then placed in ice-water for 2 hours, and the crystals which form are afterwards collected on a tared asbestos filter. Any crystals remaining in the precipitation vessel are rinsed on to the filter with a portion of the filtrate. The filter and crystals are washed with 3 or 4 small quantities of ice-water, using not more than 10 c.c. altogether, dried at 105° for 1 hour, and weighed. The weight of the crystals multiplied by 0.168 gives the quantity of nitric acid ( $\text{HNO}_3$ ) present.

A preliminary test may be made by treating 5 c.c. of the water with 1 drop of dilute sulphuric acid and 6 drops of the "nitron" solution. Should no crystals be obtained within 1 hour, the water contains less than 0.025 gram of nitric acid per litre. The reagent is best prepared

by dissolving the base in 5 per cent. acetic acid, warming the solution, and filtering off any insoluble matter. W. P. S.

**Titration of Phosphoric Acid.** OTTOKAR J. HLAVNÍČKA (*Zeit. angew. Chem.*, 1905, 18, 655—656).—A reply to Raschig (this vol., ii, 284). The author uses a slightly different process originated by Hundeshagen. The magnesium precipitate obtained in due course is washed on a hardened filter with a 2.5 per cent. solution of ammonia, and then with alcohol until free from alkali. It is removed from the filter by means of a wash-bottle, using about 200 c.c. of water, and titrated in a porcelain dish by first adding an excess of 3/10.N hydrochloric acid, and then working back with 3/10.N sodium hydroxide. Five drops of a solution of methyl-orange (1 : 1000) serve as indicator. One c.c. of the acid = 0.01065 gram of  $P_2O_5$ , or 0.0060 gram of  $MgO$ . L. DE K.

**Pemberton's Method for the Estimation of Phosphoric Acid.** D. J. HISSINK and H. VAN DER WAERDEN (*Chem. Centr.*, 1905, i, 1188—1189; from *Chem. Weekbl.*, 1905, 2, 179—184).—This method is applied by the authors to the estimation of phosphoric acid soluble in water in manures as follows: 20 grams of the sample are shaken with 900 c.c. of water for 30 minutes and diluted to 1 litre. To 5 c.c. of the filtrate are added 10 c.c. of nitric acid, 15 c.c. of ammonium nitrate solution, and 25 c.c. of water containing 25 mg. of sulphuric acid. The precipitate obtained on treating this solution with Pemberton's molybdate reagent (10+5) has the composition  $(NH_4)_3PO_4 \cdot 12.65MoO_3$ , and is neutralised by 24.3 mols. of sodium hydroxide. L. DE K.

**Estimation of Phosphoric Acid in Thomas Slag.** F. WESTHAUSSER (*Zeit. anal. Chem.*, 1905, 44, 187—191).—Certain varieties of basic slag give too high a result for the citrate-soluble phosphoric acid in consequence of the solution containing silicic acid, which passes into the magnesia precipitate. Several methods have been proposed for overcoming this difficulty (compare Böttcher, *Abstr.*, 1904, ii, 148). The author has made comparative estimations with four of these methods, namely, Böttcher's, Wagner's, Hallenser's, and one adopted by the (German) Association of Agricultural Experimental Stations, which consists in evaporating the citric acid extract with hydrochloric acid to a syrupy consistence for the removal of the silica. All four methods gave results agreeing passably, although Wagner's gave slightly higher numbers than the other three. M. J. S.

**Maercker-Bühning's Solution, Wagner's Magnesium Citrate Mixture, and Ferrous Citrate Magnesium Mixture.** HANNO SVOBODA (*Chem. Zeit.*, 1905, 29, 453—456).—A study of the solvent action of these three solutions on the glass vessels in which they are stored. The amount of silica dissolved by the two Wagner solutions is not, however, large enough to seriously affect the estimation of citrate-soluble phosphoric acid in basic slags (compare also *Abstr.*, 1904, ii, 147). L. DE K.



**Detection of Certain Acids [Boric and Volatile Organic].** V. CASTELLANA (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 465—467).—The author reviews the methods given for the detection of boric acid, and gives the following new method, which is based on a reaction characteristic of boric acid alone, and is able to reveal mere traces of the acid. A little of the substance, mixed with excess of potassium ethyl sulphate, is heated in a small tube closed at one end, and the first vapours which escape are ignited; if boric acid is present, the flame produced is edged with green. In the application of this method to food materials, for example, milk, the latter is first shaken to distribute any calcium borate which may have settled to the bottom, and from 5 to 10 c.c. of the liquid then evaporated to dryness; the residue is calcined with potassium nitrate and the ash tested as above.

Potassium ethyl sulphate may also be used to detect certain organic acids, such as formic, acetic, butyric, valeric, pelargonic, oxalic, benzoic, salicylic, and cinnamic acids, and also  $\beta$ -naphthol. The acid or, better, one of its salts is gently heated with potassium ethyl sulphate, when the characteristic odour of the ethyl ester of the acid is emitted.

T. H. P.

**Estimation of Carbon and Hydrogen in Organic Compounds.** FRITZ PREGL (*Ber.*, 1905, 38, 1434—1444).—The combustion furnace is so arranged as to carry two tubes side by side. The front part of each tube is placed in an air-jacket kept at 150—180°, the following part is heated by means of stationary burners, and the back portion of each by means of a burner working on a rail, along which it is moved automatically by means of clockwork. This clockwork can be so arranged that the movement of the burner under the portion of the tube where the substance to be analysed is placed occupies 15, 50, 100, or 200 minutes.

The tube is partially filled with copper-oxide-asbestos obtained by very gently heating copper-asbestos in air. This is kept in place by means of small pieces of copper gauze, 5 cm. long, placed alternately at right angles to one another. Coils of copper gauze are placed in front and behind the asbestos. Then follow a length of 6 cm. of granular lead peroxide, a plug of glass wool, the boat, and lastly the diffusion plug of hard glass. The tube should be dried before each combustion. Compounds containing nitrogen, sulphur, chlorine, and bromine can be analysed in this way, but not those containing iodine; if this element is present, silver-asbestos should be introduced into the tube.

Wenzel's modification of the Geissler potash bulbs is recommended.

There is no need to watch the experiment when the clockwork is once set in motion, provided the oxygen supply is properly regulated.

J. J. S.

**Estimation of Silicon in 50 per cent. Ferro-silicon.** K. (*Chem. Centr.*, 1905, i, 1190; from *Stahl u. Eisen*, 25, 334).—0.5 gram of the impalpable powder is gently fused with 6 grams of coarsely powdered potassium hydroxide for half an hour in a closed nickel crucible supported by wire gauze. The heat is then increased,

and after 20 minutes the crucible is allowed to cool and the fused mass is dissolved in hot water. The silica is then separated as usual by evaporation with hydrochloric acid, &c. L. DE K.

**Estimation of Alkalis in Silicates by L. Smith's Method.** BENJAMIN M. MARGOSCHES (*Chem. Zeit.*, 1905, 29, 385).—A reply to Steinlen (this vol., ii, 349). L. DE K.

**Detection of Sodium Salts [by means of Potassium Pyroantimoniate].** J. BOUGAULT (*J. Pharm. Chim.*, 1905, 21, 437—442).—The most favourable conditions for carrying out this well-known test are given. The reagent is prepared by heating 1 gram of antimony trichloride with a mixture consisting of 10 c.c. of 33 per cent. potassium hydroxide solution and 45 c.c. of hydrogen peroxide (10 vols.). After about 5 minutes' heating, the solution is cooled and filtered. On adding 0.5 c.c. of the filtrate to a small quantity of a solution containing a sodium salt, a precipitate is obtained. The precipitation is favoured by gently heating the mixture and then cooling it. With 0.4 mg. of sodium chloride, a precipitate is obtained at once. If potassium or lithium salts are present in the sodium salt to be tested, they must be removed previously. Sulphuric acid must be removed, as must also chlorine, bromine, and iodine. The solution of the sodium salt must be neutral or alkaline in reaction and the sodium should preferably be present as tartrate. W. P. S.

**Reactions for distinguishing Calcite and Dolomite.** STANISLAUS J. THUGUTT (*Centr. Min.*, 1905, 265—266).—Following on the work of Meigen (*Abstr.*, 1901, ii, 692), F. Hinden (*Verh. Naturforsch. Ges. Basel*, 1904, 15, 201) has tried the effects of solutions of ferric chloride, copper sulphate, lead acetate, and mercuric chloride on calcite and dolomite. A fragment of calcite, when placed in a 10 per cent. solution of ferric chloride, becomes coated in 1—2 minutes with a dark reddish-brown deposit of iron hydroxide, whilst dolomite remains unaltered. In the present note, it is pointed out that this reaction was used in 1887 by J. Lemberg, who also, in 1888 and 1892, devised several other micro-chemical colour reactions for distinguishing between calcite and dolomite. L. J. S.

**New Method of estimating Magnesium Carbonate in Limestone.** W. F. KOPPESCHAAR (*Zeit. anal. Chem.*, 1905, 44, 184—187).—A large quantity (50 grams) of the limestone is dissolved in the smallest possible excess of hydrochloric acid, and the greater part of the calcium is precipitated by the addition of concentrated sulphuric acid. The whole of the magnesium then remains in solution with comparatively little calcium. These are separated in the filtrate by the ordinary method, but the quantity of magnesia carried down by the calcium oxalate is too small to require notice. M. J. S.

**Analysis of Bar Copper (Reply to Hampe's Criticism).** ERNST MURMANN (*Zeit. anal. Chem.*, 1905, 44, 269—286. Compare *Abstr.*, 1897, ii, 346; 1898, ii, 353).—For the estimation of oxygen,

the author objects to the use of filings of the metal. Owing to the compressive action of the file, it is impossible to free the surface from organic matter (often unsaponifiable) by the short boiling with alkali which alone is permissible. The sample used must be in solid fragments, taken either by sawing or cutting, and must be freed from grease, &c., by chloroform. With regard to the electrolytic estimation of copper the author argues that the method does not possess the degree of accuracy claimed for it by Hampe, since the copper deposited electrolytically and the platinum on which it is deposited undoubtedly condense weighable but uncertain amounts of air and moisture. Rose's method, if the temperature of ignition is restricted to the neighbourhood of  $650^{\circ}$ , is of at least equal accuracy, but when a mixture of hydrogen sulphide with hydrogen is used, it is necessary to replace this by carbon dioxide before cooling, since at about  $200\text{--}250^{\circ}$  there is a tendency to the formation of some cupric sulphide. The sublimation of arsenic and antimony from copper by heating in hydrogen is complete at a temperature below the melting point, but not when the copper is fused, as was the case in Hampe's experiments, since the diminution of the surface more than compensates for the higher temperature. Only a small fraction of the lead present sublimes out.

M. J. S.

**Titration of Copper by Potassium Iodide in presence of Arsenic: a Correction.** L. MOSER (*Zeit. anal. Chem.*, 1905, 44, 196. See this vol., ii, 64).—The precipitate which the author obtained on adding sodium pyrophosphate to sodium arsenate is found to have been produced by an impurity (calcium) in the specimen of arsenate used. Pure arsenate gives no precipitate with pyrophosphate. This correction, however, in no way modifies the author's method. M. J. S.

**Estimation of Small Quantities of Iron.** J. WALTER LEATHER (*J. Soc. Chem. Ind.*, 1905, 24, 385—387).—Quantities of iron too small to admit of the use of the ordinary methods may be determined by means of Lovibond's tintometer. The two colour reactions, the ferrocyanide and the thiocyanate, are both applicable to the purpose, but the colorations must, within certain limits, be produced in the presence of a constant relation of reagent to iron. In the case of the ferrocyanide reaction, 1 drop of concentrated hydrochloric acid and 1 drop of 10 per cent. potassium ferrocyanide solution were added to 20 c.c. of the iron solution, when 0.001 gram of ferric oxide gave a coloration equivalent to 9 blue + 1 yellow + 3 red units of the tintometer in a  $\frac{1}{8}$ -inch cell. The use of the red units was necessary as the blue glasses were not so blue as the ferrocyanide coloration. The thiocyanate reaction appears to be more delicate than the ferrocyanide with minute traces of iron, as little as 0.00001 gram being determined with very considerable accuracy. With this coloration, only 2 sets of glasses are required, red and yellow, 0.001 gram of iron in 20 c.c. being found equivalent to 21 red + 18 yellow units in a  $\frac{1}{8}$ -inch cell. The quantity of thiocyanate to be added is 90 times the amount of iron present, or 0.09 gram of potassium thiocyanate for 0.001 gram of iron. Two



drops of saturated potassium thiocyanate solution will contain this amount. A drop of hydrochloric acid must also be added.

W. P. S.

**Separation of Iron and Aluminium from Manganese, Calcium, and Magnesium in Ash Analysis.** PAUL KASCHINSKY (*J. Landw.*, 1905, 53, 179—185).—Determinations by the methods of König and Tollens of calcium and phosphoric acid in solutions of hydrogen disodium phosphate to which known amounts of calcium chloride were added showed that calcium phosphate may be precipitated with the ferric phosphate in considerable quantity according to the amounts of free acetic acid and of calcium and phosphoric acid present.

N. H. J. M.

**New Characteristic Reaction of Cobalt.** M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1905, 10, 147).—The strongly-diluted cobalt solution is mixed with a few drops of an alcoholic solution of phenyl- or  $\beta$ -naphthyl-thiohydantoic acid, and then with a drop of ammonia. A crimson-red coloration is at once formed. With stronger solutions, a reddish-brown precipitate is formed. If nickel is present, a little more ammonia should be added, which dissolves the grey nickel precipitate to a colourless liquid.

L. DE K.

**New Iodised Compound of Osmium.** EUGENIO P. ALVAREZ (*Chem. News*, 1905, 91, 172—174).—When a solution of potassium iodide strongly acidified with hydrochloric or phosphoric acid is shaken with a drop of an aqueous solution of osmium peroxide, in the course of a minute or two a green osmium hydriodide,  $\text{OsI}_2 \cdot 2\text{HI}$ , forms. In the presence of ether, the reaction becomes exceedingly delicate, and a few millionths of a gram of osmium may be detected by the green tint in the ethereal layer. It is also produced when the osmium solution in presence of ether and iodine, dissolved either in water, potassium iodide, or hydriodic acid, is treated with sulphurous acid. It is soluble in water and ether, but insoluble in benzene and chloroform; it turns red in the air or when treated with nitric acid, but in solution is rendered more stable by the presence of calcium or other such chloride; nitrites precipitate osmium hydroxide from the acid solution, and permanganate and dichromate solutions are reduced by it.

D. A. L.

**Variations in the Rotatory Power of Oil of Turpentine.** L. RABY (*Ann. Chim. anal.*, 1905, 10, 146—147).—The author submitted a sample of oil of turpentine to fractional distillation, and noticed that each of the five fractions had a rotatory power less intense than that of the original sample; it must, however, be remarked that this particular sample was acid and moist.

After a lapse of four months, the rotatory power of the first four fractions had, however, sensibly increased. It was noticed that this increase may be induced at once by addition of an equal bulk of olive oil.

L. DE K.

**Estimation of Inspired and Expired Chloroform.** AUGUSTUS D. WALLER and BERTRAM J. COLLINGWOOD (*Proc. Physiol. Soc.*, 1905, xxiv—xxviii; *J. Physiol.*, 32).—The estimation of chloroform in the expired air by the densimetric method is a more difficult thing than in atmospheric air. The principal corrections to be made are for carbon dioxide, respiratory quotient, aqueous vapour, temperature, and pressure. The method of dealing with each is described. In high values of chloroform absorption, the corrections are less influential than in low values.

W. D. H.

**Detection of Iodoform.** WILLEM STORTENBEKER (*Rec. Trav. chim.*, 1905, 24, 66—68).—It is pointed out that the toxicological detection of iodoform is difficult owing to the rapidity with which this substance is transformed, probably into an iodate, in the animal economy. For its isolation, the author recommends distillation of the material with steam, care being taken that the mixture is slightly acid. If the iodoform does not crystallise out of the distillate, it is extracted with ether and the solvent allowed to evaporate spontaneously in the dark; the residue is then recrystallised from acetic acid, since the latter does not dissolve readily the fatty acids and similar matters which are usually found with the iodoform in the distillate, and examined microscopically. The red coloration given by iodoform with sodium phenoxide is unsatisfactory for the detection of the former, since chloroform and bromoform produce the same colour.

T. A. H.

**Estimation of Sodium Ethoxide with Menthone.** CARL TUBANDT (*Annalen*, 1905, 339, 41—93).—Vorländer's method (*Abstr.*, 1903, i, 230) of estimating sodium ethoxide in the presence of the sodium salts of weak acids has been investigated more fully. Sodium ethoxide effects the inversion of *l*-menthone into *d*-menthone or *vice versa*; the velocity of the inversion of *l*-menthone was found to be proportional to the concentration of the sodium ethoxide except in very dilute solutions. The velocity is independent of the presence of neutral sodium salts, such as sodium acetate, bromide and iodide, and potassium iodide and the sodium derivative of dihydroresorcinol; neutral esters are also without influence. The presence of menthone or menthol has no effect. Addition of water or of benzene diminishes the velocity of inversion.

*d*-Menthone behaves in an exactly similar manner.

Vorländer and Tubandt's observations (*loc. cit.*) on the use of the inversion of menthone as a means of estimating the acid character of organic compounds and of determining the relative strength of weak acids have been extended; the alcoholysis of salts in absolute alcoholic solution has also been followed quantitatively. The relations holding for hydrolysis are found to apply to alcoholysis, the amount of the decomposed salt being proportional to the square root of the concentration of the undecomposed salt, thus  $K = x^2/(1-x)V$ .

The inverting action of amines and acids on *l*-menthone has also been investigated.

K. J. P. O.

**The Inversion of Cane Sugar in the presence of Milk Constituents.** FRANCIS WATTS and H. A. TEMPANY (*Analyst*, 1905, 30, 119—123).—In the analysis of condensed milk, the authors find that the presence of some constituent of the milk exerts a marked retarding influence on the inversion of cane sugar by citric acid. Boiling for 10 minutes is insufficient, and to obtain complete inversion the boiling should be continued for at least 40 minutes. It is shown that lactose is not the retarding constituent, and also that citric acid is entirely without inverting action on lactose even after heating for 2 hours.

W. P. S.

**Laboratory Notes [Chloroacetic Acids and their Estimation and Separation].** JOHAN F. A. POOL (*Chem. Centr.*, 1905, i, 1005—1006; from *Pharm. Weekblad*, 42, 165—168).—The gas obtained by heating trichloroacetic acid with a solution of potassium hydroxide contains carbon monoxide.

The quantities of acetic, chloroacetic, dichloroacetic, and trichloroacetic acids in a mixture of these acids may be estimated by the following method. The solution is titrated with a normal solution of potassium hydroxide. If  $a$  = c.c. of alkali required,  $M_a$ ,  $M_m$ ,  $M_d$ , and  $M_t$  the molecular weights, and  $p$ ,  $q$ ,  $r$ , and  $s$  the weights of acetic, chloroacetic, dichloroacetic, and trichloroacetic acids respectively in a given volume of the solution, then

$$a = 1000p/M_a + 1000q/M_m + 1000r/M_d + 1000s/M_t.$$

An equal volume of the solution is boiled with an excess of potassium hydroxide solution, and the potassium carbonate, which is formed by the action of the alkali on the trichloroacetic acid, is then estimated by precipitating as barium carbonate and titrating with a normal solution of acid. If  $b$  = c.c. of acid required, then  $b = 2000s/M_t$ .

An equal volume of the solution of the acids is boiled with an excess of lime water. Dichloroacetic acid (4 mols.) yields calcium oxalate (2 mols.) and calcium glycolate (2 mols.). The calcium salts are separated by means of acetic acid and the calcium carbonate obtained from the oxalate is weighed. If  $c$  = weight of calcium carbonate, then  $c = 100(1000r/2M_d)$ .

Finally an equal volume of the mixture of acids is boiled with potassium hydroxide solution in a reflux apparatus and the chlorides are precipitated by silver nitrate. If  $d$  = weight of silver chloride, then  $d = 143.38(1000q/M_m + 2000r/M_d + 3000s/M_t)$ ;  $p$ ,  $q$ ,  $r$ , and  $s$  may be calculated from the four equations thus obtained.

Potassium nitrite reacts with chloroacetic acid to form potassium chloroacetate and nitrous acid. The chloroacetates, however, do not behave in the same way in hot aqueous solution. The non-dissociated molecules of potassium chloroacetate react with a solution of potassium nitrite, forming methyl nitrite, potassium chloride, and potassium hydrogen carbonate, whilst in the dissociated portion the ionic reaction,  $\text{CH}_2\text{Cl}\cdot\text{CO}_2\cdot + \cdot\text{OH} = \text{OH}\cdot\text{CH}_2\cdot\text{CO}_2\cdot + \text{Cl}\cdot$ , occurs. The quantity of nitrite cannot therefore be estimated by determining the quantity of chlorine ions formed. The second reaction may be prevented, however, by adding a concentrated



solution of a salt with a similar ion, such as potassium sulphate or potassium nitrate.

E. W. W.

**Estimation of Condensed Glycuronic Acids. IX.** CARL NEUBERG and WILHELM NEIMANN (*Zeit. physiol. Chem.*, 1905, 44, 127—134. Compare Abstr., 1899, i, 933; this vol., i, 412).—Phenolglycuronic acid and its homologues are most readily estimated by heating with 1—3 per cent. solution of hydrobromic acid in presence of bromine at 100° in sealed tubes and determining the amount of saccharic acid thus formed. This is effected by converting into the basic barium salt and precipitating as normal silver salt.

Good results are not obtained with euxanthic or urochloric acid.

Phenolglycuronic acid may be estimated in urine by a similar method if the urine is precipitated with saturated barium hydroxide solution, filtered, freed from excess of baryta by means of carbon dioxide, and the clear solution evaporated to 5—8 c.c. Alkyl hydrogen sulphates do not interfere with the estimation.

J. J. S.

**Colorimetric Estimation of Salicylic Acid in Foodstuffs.** FRED. T. HARRY and W. R. MUMMERY (*Analyst*, 1905, 30, 124—127).—The method described is particularly applicable to the estimation of salicylic acid in foods and beverages containing tannin, and is based on the solubility of lead salicylate in alkaline solutions, lead tannate being insoluble. Fifty grams of the crushed sample (jam, fruit pulp, &c.) are placed in a 300 c.c. flask, together with a little water, and 15 to 20 c.c. of a saturated basic lead acetate solution are added. The mixture is then rendered alkaline by adding 25 c.c. of approximately *N*/1 sodium hydroxide solution, after which 15 to 20 c.c. of *N*/1 hydrochloric acid are added and the whole diluted to 300 c.c. The contents of the flask are now mixed, poured on to a filter, and 200 c.c. of the filtrate collected. The filtrate is acidified with hydrochloric acid, filtered again if necessary, and extracted three times with ether. After distilling off the ether, the residue is dissolved in alcohol, made up to 100 c.c., and the salicylic acid in it estimated colorimetrically with ferric chloride as usual. Samples containing alcohol, such as beer or wine, must be rendered slightly alkaline, the alcohol evaporated off, and then neutralised, before proceeding with the separation.

W. P. S.

**Solubility of Glycerides in Acetic Acid and its Application to the Analysis of Butter.** L. HÖRON (*Rev. intern. Falsif.*, 1905, 18, 20—23).—Five grams of the butter or fat under examination are placed in a tube 16 mm. in diameter and provided with a tap. Ten c.c. of acetic acid of sp. gr. 1.057 are added and the whole placed in a water-bath until the contents of the tube are heated to a temperature of 60°, as shown by a thermometer inserted in the tube. The latter is then withdrawn from the water-bath and, when its contents have cooled to 35°, the lower layer is drawn off into a basin, evaporated at 70°, and weighed. The portion remaining in the tube is treated once more with 10 c.c. of acetic acid and a second residue obtained. The fatty layer is finally itself evaporated. In this way, three fractions are obtained which yield certain constants for one and the same kind

of fat. The following results were given by the three fractions—A, B, and C—obtained from various fats:

	Margarine.			Lard.			Cotton oil.			Earthnut oil.		
	W.	C.	R.	W.	C.	R.	W.	C.	R.	W.	C.	R.
Fraction A.....	30	72	49.8	31	63	50.5	65	52	63	42	57	59
„ B.....	48	74	49.5	50	67	49.7	70	54	63.2	68	67	58.8
„ C.....	423	80	49	420	78	49.3	360	70	59.2	395	78	56

W = weight of fraction in centigrams; C = Crismer value (Abstr., 1896, ii, 506); R = refraction at 40°.

A sample of butter having a Reichert-Meissl value of 25.3, Crismer value 51, and refraction 42.8, gave the following results:

	W.	C.
Fraction A.....	109	43
„ B.....	182	49
„ C.....	193	57

The author has also studied the influence of the addition of cocoanut oil to butter, and found that it only slightly alters the relation of “C” to “A,” but that the weight of the fraction “C” is considerably diminished.

W. P. S.

**Estimation of Moisture and Free Alkali in Soaps.** KARL BRAUN (*Zeit. angew. Chem.*, 1905, 18, 573—574).—A suitable quantity of the cut-up soap is weighed into an Erlenmeyer flask of about 125 c.c. capacity and then dried in a water oven to constant weight. During the drying, the flask is fitted with a caoutchouc cork through which passes a rather wide, doubly-bent tube filled with soda-lime, which prevents the entrance of any carbon dioxide and also materially assists the drying process.

The residue is then dissolved in as little alcohol as possible and the free alkali titrated with standard acid, using phenolphthalein as indicator.

L. DE K.

**The Presence of Cotton-seed Oil in Lards from Hogs fed on Cotton-seed Meal.** A. D. EMMETT and HARRY S. GRINDLEY (*J. Amer. Chem. Soc.*, 1905, 27, 263—270).—The authors have proved by a number of experiments that when hogs are fed on cotton-seed meal a portion of the cotton-seed oil is absorbed and transmitted in its unaltered condition to the fat cells. This was proved by applying to the lard obtained the Bechi, nitric acid, and Halphen tests; also the following general tests for vegetable oils: Welman's phosphomolybdic acid reaction, Tollen's phloroglucinol reaction for pentosans, and Salkowski's chloroform-sulphuric acid test for cholesterol or phytosterol. Crystals resembling the latter substance were also obtained.

L. DE K.

**Solubility of Quinine in Ammonia. Testing of Quinine Sulphate.** WILLIAM DUNCAN (*Pharm. J.*, 1905, 74, 438—440).—Whilst quinine dissolves in ammoniacal solutions, the increased solubility, as compared with water alone, is more apparent than

real, and is due to supersaturation. Solutions containing 10 and 32.5 per cent. of ammonia were saturated with quinine, and after four months the amount of quinine in solution was determined. The solubility in 10 per cent. ammonia was found to be 1 in 2286, and in 32.5 per cent. ammonia 1 in 2505. Pure water dissolves (U.S.P.) 1 in 1960. Loss of quinine frequently takes place when, in estimating the alkaloid, ammonia is used to precipitate it. This is partly due to supersaturation, and also to hydrolysis of the ammonium salt when the precipitated alkaloid is being washed. The author, therefore, prefers calcium hydroxide solution as a precipitant. The quinine is at once precipitated and contains no calcium sulphate. W. P. S.

**Estimation of Extract in Barleys.** ALBERT REICHARD and GEORG PURUCKER (*Chem. Centr.*, 1905, ii, 904; from *Zeit. ges. Brauw.*, 28, 37—38).—Twenty-five grams of barley-flour are heated for 25 minutes on the water-bath with 100 c.c. of water, cooled to 45°, and mixed with 8 c.c. of a malt infusion made by treating 1 part of malt with 4 parts of water for 6 or 8 hours. After heating for half an hour at 45°, the solution is boiled on a sand-bath for half an hour, the evaporated water being constantly replaced by boiling water. After cooling to 45—50°, another 2 c.c. of malt infusion are added, and the whole is again gradually heated to 70°, at which temperature it is kept for an hour. When cold, the solution is diluted to 400 c.c. and the extract calculated from the sp. gr. as usual. Allowance is, of course, made for the solids (less the coagulable proteids) introduced by the malt solution. L. DE K.

**Identification of Lecithin.** RIEDEL (*Chem. Centr.*, 1905, i, 772—773; from *Apoth. Zeit.*, 20, 92—93).—An alcoholic solution of lecithin gives characteristic precipitates with cadmium and platinic chlorides. On heating with excess of baryta water, lecithin is gradually converted into fatty acids, glycerophosphoric acid, and choline. On removing the excess of barium oxide with carbon dioxide, the barium salts of the fatty acids remain undissolved, whilst the other products pass into solution. On evaporating to dryness and extracting with alcohol, the choline dissolves, and may be identified by its platinichloride. The glycerophosphate may be oxidised with nitric acid and the phosphoric acid identified by ammonium molybdate. The barium salts of the fatty acids may be decomposed by heating with dilute hydrochloric acid and the fatty acids extracted with ether. On agitating with dilute sodium hydroxide, the acids may be removed, and any cholesterol or phytosterol recovered from the solution. The amount of lecithin may be calculated from the quantity of phosphorus found, as 100 parts of lecithin = 3.94 parts of phosphorus (compare also this vol., i, 164). L. DE K.



## General and Physical Chemistry.

**Increase in the Rotatory Power of Aliphatic Compounds on Transformation into Cyclic Compounds.** ALBIN HALLER and MARCEL DESFONTAINES (*Compt. rend.*, 1905, 140, 1205—1208. Compare *Abstr.*, 1903, i, 503, 563).—Esters of 4-methyl-2-cyclopentanonecarboxylic acid were prepared by condensation from  $\beta$ -methyladipic esters and by treatment of the former compounds with metallic sodium and alkyl iodides a series of 4-methyl-1-alkyl-2-cyclopentanonecarboxylic esters was prepared. From these,  $\gamma$ -methyl- $\alpha$ -alkyladipic acids were obtained by saponification. The boiling point (or freezing point), density, and rotatory power of the esters are given.

### *Esters of $\beta$ -Methyladipic Acid.*

Ester	Boiling point.	mm. pressure.	Sp. gr.	$[\alpha]_D$ .
Methyl .....	126°	16	1·008 at 18°	3°49'
Ethyl .....	138	15	1·04 „ 18	2 24
Propyl .....	166—167	16	0·964 „ 20	2 10
isoButyl.....	178—180	20	0·947 „ 18	2 9

### *Esters of 4-Methyl-2-cyclopentanonecarboxylic Acid.*

Methyl .....	110°	16	1·07 at 15°	+91° 7'
Ethyl .....	118	18	1·05 „ 15	78 24
Propyl .....	123—124	15	1·029 „ 15	64 45
isoButyl.....	145	25	0·956 „ 15	66 9

### *Esters of 4-Methyl-1-alkyl-2-cyclopentanonecarboxylic Acids.*

Ester.	Alkyl radicle.	Boiling point.	mm.	Sp. gr. at 15°.	$[\alpha]_D$ .
Methyl	Methyl	105—106°	15	1·053	78°58'
„	Ethyl	108—111	15	1·041	59 14
„	Propyl	138—140	22	1·02	53 3
„	Allyl	126—128	13	1·029	58 18
Ethyl	Methyl	112—113	15	1·01	70 0
„	Ethyl	124	15	1·01	51 7
„	Propyl	136—137	15	1·06	51 8
„	Allyl	139—141	18	1·01	62 16
„	isoButyl	188—190	20	0·994	30 33
Propyl	Methyl	125—128	14	0·991	50 28

### *$\gamma$ -Methyl- $\alpha$ -alkyladipic Acids.*

Alkyl radicle.	Melting point.	$[\alpha]_D$ .
Methyl .....	80°	+ 4°41'
Ethyl .....	97—98	13 31
Propyl .....	110	16 58
Allyl .....	104	27 53

The rotatory power of the acids was determined in alcoholic solution at a concentration approximately equal to 1/50 mol. per litre.

The numbers show the great influence of ring formation on the rotatory power, the values for the esters of 4-methyl-2-cyclopentane-carboxylic acid being about thirty times as great as those for the corresponding esters of  $\beta$ -methyladipic acid. With increasing molecular weight, the specific rotatory power diminishes. The introduction of alcohol groups in the 1-position in the 4-methylcyclopentane-2-carboxylic esters diminishes the rotatory power. The allyl derivatives have a greater rotatory power than the propyl derivatives.  
H. M. D.

**Cathode Luminescence of Crystals.** ALFREDO POCHETTINO (*Nuovo Cimento*, 1904, [v], 8, 438—445).—Every mineral capable of becoming luminous under the influence of the cathode rays emits light of a characteristic colour, which, for minerals belonging to the same group, is independent of the natural colour of the crystal. In some minerals, for example, calcite and apatite, the colour of the cathode luminescence is identical with that of the fluorescence excited in it by ordinary light; in others, for instance, phosgenite and cerussite, it is similar; whilst in aragonite and certain others it is totally different. The duration of this luminescence after the cathode rays have ceased to act varies in different minerals, and is marked in calcite and orthoclase. The excitation of cathode luminescence is not equally easy with all minerals, and takes place very readily with scheelite, apatite, and anatase. The luminescence is not completely polarised in any of the minerals examined by the author, and with some, for example, anglesite and calcite, it exhibits no trace of polarisation. Inclination of the face to the cathodic pencil does not alter the qualitative relations of the phenomenon. The orientation of the plane of polarisation is not the same in crystals of the tetragonal and hexagonal systems. Anisotropy, artificially produced in an amorphous substance, produces a greater or less partial polarisation of its cathode luminescence, and to extinguish the polarised portion of the latter the short diagonal of the analyser must be placed parallel to the direction of tension and normal to the direction of compression. T. H. P.

**Triboluminescence of Potassium Sulphate.** DÉSIRÉ GERNEZ (*Compt. rend.*, 1905, 140, 1234—1236).—It has been previously observed by H. Rose and by Bandrowski (*Abstr.*, 1895, ii, 66 and 429) that when potassium and sodium sulphates are fused together in molecular proportion, the product dissolved in water and left to crystallise, the separation of the potassium sulphate crystals is accompanied by the emission of flashes of light. The author shows that if the hot solution of the fused sulphates is allowed to crystallise without being disturbed by external influences there is no emission of light, but flashes of light are at once observed if a crystal is touched with a piece of iron, silver, or platinum. The phenomenon appears, therefore, to be due to the disintegration of crystals already formed, and this disintegration can be readily brought about by the agitation of the containing vessels. The admixed sodium sulphate can be replaced by other substances without interfering with the phenomenon, and it

has been finally shown that crystals of potassium sulphate separating from pure aqueous solution also exhibit triboluminescence.

H. M. D.

**Triboluminescence of Metallic Compounds.** DÉSIRÉ GERNEZ (*Compt. rend.*, 1905, 140, 1337—1339. Compare this vol., ii, 365).—The author has examined crystals of 100 different substances, of which 74 were inorganic salts and the remainder metallic salts of organic acids, and finds that all emit light when rubbed in a glass vessel with a platinum rod. This property is not therefore manifested especially by organic substances (compare Tschugaeff, *Abstr.*, 1901, ii, 489).

T. A. H.

**Some New Effects produced by Radium Bromide on a Photographic Plate.** JOSEF PETRI (*Ann. Physik*, 1905, [iv], 16, 951—957).—Coins are placed on a covered photographic plate and exposed in a magnetic field to the action of radium bromide. The images of the coins on the developed plate exhibit outgrowths at their nearest points, and these are attributed to joint magnetic and thermo-electric action, in virtue of which the separate rays are crowded so much as to leave an impression on the plate.

J. C. P.

**Influence of Radium on the Respiratory Energy of Germinating Grains.** H. MICHEELS and P. DE HEEN (*Acad. Roy. Belg.*, 1905, 29—34).—The experiments of the authors indicate that the radiations emitted by radioactive compounds diminish the quantity of carbon dioxide evolved by germinating grains, that is, diminish the respiratory activity.

L. M. J.

**Radioactivity of the Common Metals.** AUGUSTO RIGHI (*Nuovo Cimento*, 1905, [v], 9, 53—64).—By placing an electrometer in a closed vessel containing carbon dioxide together with a disc of metal, cleaned immediately beforehand by means of glass paper, the author obtains the following values for the velocity of discharge of the electrometer in volts per hour:

Aluminium	...	23	Iron	...	22.9
Antimony	...	24.8	Lead	...	32.5
Bismuth	...	29.8	Silver	...	23
Cadmium	...	24.5	Nickel	...	22.9
Copper	...	23.1	Tin	...	24.4
Glass	...	22.4	Zinc	...	24.3

Lead exhibits a curious behaviour, the rate of discharge being 38 after a quarter of an hour, 33 after a further half an hour, and 24 after a further two hours; the maximum value can only be obtained again by cleaning the lead with glass paper.

The nature of the emanation from the metals which produces the discharge is unknown.

T. H. P.



**Radioactive Properties of Air, Soil, and Water in and around Halle.** RICHARD SCHENK (*Jahrb. Radioakt. Elektronik*, 1905, 2, 19—42).

**A New Radioactive Element which emits Thorium Radiation.** OSKAR HAHN (*Zeit. physikal. Chem.*, 1905, 51, 717—720).—In fractionating a mixture of bromides obtained from thorianite, it was found that whilst the radium accumulated in the least soluble fractions, the radioactivity of the most soluble portions also increased. Finally, a strongly active oxalate precipitate of about 10 mg. was obtained, which glows faintly in the dark and excites the platinocyanide and zinc sulphide screens in a marked fashion. If a current of air is blown through a solution of the substance and directed against a zinc sulphide screen, the illumination of the latter is somewhat similar to that observed in a parallel experiment with emanium. It is shown, however, that the substance cannot be actinium or emanium. The emanation from the substance is almost identical with that of thorium, but the substance itself is 100,000—200,000 times as active as thorium, and is supposed to contain a new radioactive element. J. C. P.

**The Degradation Constant of the Emanations from Emanium and Actinium.** OSKAR HAHN and OTTO SACKUR (*Ber.*, 1905, 38, 1943—1946. Compare Sackur, this vol., ii, 367).—The rates of decay of the activities of emanations from emanium and actinium have been determined. The activity of emanium emanation is reduced to one-half of its maximum value in 3.6 seconds, and the actinium emanation in 3.9 seconds.

The time taken for the degradation of the induced activity produced from emanium and actinium is the same, and the two elements are therefore probably identical. J. J. S.

**Application of the Wehnelt Interrupter in the Measurement of Dielectric Constants by Nernst's Method.** FRIEDRICH KRÜGER (*Zeit. physikal. Chem.*, 1905, 51, 739—740).—Hints as to the most favourable working conditions. J. C. P.

**Temperature-coefficient of the Resistance of Tantalum.** FRANZ STREINTZ (*Zeit. Elektrochem.*, 1905, 11, 273—274).—The temperature-coefficients of the electrical resistances of tantalum, platinum, and bismuth, with the atomic weights 183, 195, and 208, are 0.3, 0.37, and 0.45 per cent. respectively, in agreement with a rule previously noticed (*Abstr.*, 1902, ii, 595).

The atomic heat of tantalum probably varies with the temperature and cannot therefore follow the law of Dulong and Petit.

T. E.

**Conductivity of Colloidal Solutions.** JACQUES DUCLAUX (*Compt. rend.*, 1905, 140, 1468—1470).—Contrary to the experience of Malfitano (compare this vol., ii, 72), the author finds that the electrolytic conductivity of colloidal solutions, although small, is not negligible; a solution of Graham's ferric hydroxide containing 0.032 atom of iron per

litre and having a conductivity of  $113 \times 10^{-6}$  was separated by diffusion through a collodion membrane into a colourless filtrate having a conductivity of  $82 \times 10^{-6}$  and a residue containing all the colloidal granules and having a conductivity of  $280 \times 10^{-6}$ , thus the granules themselves have a conductivity value of  $200 \times 10^{-6}$ , and the conductivity of a colloidal solution is  $1/500$  of that of a crystalloid solution of the same concentration. The corresponding ratios for solutions of copper ferrocyanide and arsenic sulphide are  $1/800$  and  $1/3500$  respectively.

M. A. W.

**Electrical Conductivity of Solutions in Ethyl Bromide. Compounds of Dimethylpyrone with Acids.** WLADIMIR A. PLOTNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1905, **37**, 318—337. Compare Abstr., 1904, ii, 156).—Solutions in ethyl bromide of the compounds formed by dimethylpyrone with trichloroacetic acid (this vol., i, 77) exhibit a marked capability for conducting an electric current. The specific conductivity of the acid salt increases continuously with the concentration, a saturated solution (containing about 30 per cent. of the compound) possessing the maximum conductivity, the magnitude of which (0.001321) coincides approximately with the specific conductivity of centinormal potassium chloride solution (0.001225). Strong solutions of the acid dimethylpyrone compound must hence be placed in the class of feeble electrolytes. The specific conductivity of the normal dimethylpyrone compound in ethyl bromide reaches a maximum at a concentration of about 56 per cent., which corresponds with the composition represented by  $C_7H_8O_2, CCl_3 \cdot CO_2H, 2EtBr$ . With both these compounds, the conductivity is diminished by the addition of dimethylpyrone, and with solutions of the acid compound the conductivity is increased by the addition of trichloroacetic acid, provided too great an excess of the acid is not present.

The author discusses the relation of these results to the constitution of dimethylpyrone and to the ionising capacity of ethyl bromide.

T. H. P.

**Ionisation and the Coefficient of Magnetisation of Aqueous Solutions.** GEORGES MESLIN (*Compt. rend.*, 1905, **140**, 1329—1331).—When the specific coefficients of magnetisation of copper sulphate, potassium ferrocyanide, and ferrous sulphate are calculated from observations of this constant, made with aqueous solutions of the salts, allowance being made for the water, the results are lower than those obtained by direct observation on the solid salts (*Compt. rend.*, 1905, **140**, 782) and the values decrease as the solutions become more dilute. Such differences are only shown by strongly magnetic salts, and seem to be due to a progressive decomposition (ionisation) with the formation of less magnetic substances. Similarly, the coefficient of magnetisation of mixtures of ethyl alcohol and water is not always intermediate between those of the two components; it reaches a maximum (1.045 compared with water as unity) when 4 per cent. of water has been added and then decreases, reaching the normal value for alcohol (1.030) when eight per cent. of water has been added.

Young has shown that the vapour tension of mixtures of alcohol and water shows a similar variation.

T. A. H.

**Free Energy and Heat Capacity.** JAMES M. BELL (*J. Physical Chem.*, 1905, 9, 381—391).—Richards has suggested the existence of a linear relation between the temperature-coefficients of total energy and of free energy which may be written  $d\Delta E/d\theta = k.d\Delta F/d\theta$  (Abstr., 1903, ii, 132). This has also formed the subject of a paper by Trevor (this vol., ii, 372). In a mathematical paper, the author comes to the conclusion that the inferences of Richards are based on insufficient experimental data, and that the existence of the linear relation just stated does not accord with experimental data and is, moreover, at variance with certain tacit assumptions in Richards' own papers.

L. M. J.

**Exact Expression for the So-called Molecular Change of Critical Temperature.** JOHANNES J. VAN LAAR (*Chem. Centr.*, 1905, i, 1355; from *Chem. Weekblad*, 2, 223—229. Compare Centnerszwer, Abstr., 1904, ii, 158).—The equation  $1/T_1.(dT_x/dx)_0 = 2\sqrt{\Theta\phi} - (1 + \phi)$ , in which  $\Theta = T_2/T_1$  or the relationship of the critical temperatures of the components and  $\phi = b_2/b_1$ , is an exact expression for the change of temperature  $T_x$  at the lowest critical temperature of the components. Only when  $\Theta$  is less than  $(1 - \phi)^2$  does the change of  $T_x$  become negative. When  $x=1$ , that is, on the side of the highest critical temperature, then the change of  $T_x$  is always positive and is expressed by the equation  $1/T_2(dT_x/dx)_{x=1} = (1 + \phi') - 2\sqrt{\Theta'\phi'}$ , in which  $\Theta' = T_1/T_2$  and  $\phi' = b_1/b_2$ .

Centnerszwer's results for sulphur dioxide agree with these equations when it is assumed that the liquefied gas has the molecular formula  $(\text{SO}_2)_2$ .

E. W. W.

**Experimental Demonstrations of Thermal Phenomena developed in Phosphorescent Substances; Validity of Physical Theories.** P. DE HEEN (*Acad. Roy. Belg.*, 1905, 22—28).—If one of the bulbs of a Leslie's thermoscope is covered with lamp-black and the other with chalk, the former absorbs more heat than the latter, and when exposed to either solar radiation or radiation from an incandescent lamp, the liquid on the lamp-black side sinks and this condition remains permanent. If, however, the lamp-black be replaced by a phosphorescent substance of about the same absorptive power as chalk and exposed to solar radiation, then, although at first the same phenomenon takes place, yet the condition is not permanent, and after about a quarter of an hour the levels again attain equality. If then exposed to radiation of great wave-length, the reverse effect takes place, but again eventually zero is attained. The author explains these facts by the supposition that for small wave-lengths a number of ions are emitted from the atom and constitute around it a sort of phosphorescent atmosphere, whilst greater wave-lengths determine the re-entrance of the phosphorescent ions into the atom. The author discusses the impossibility of finality in physical theories and hypotheses, and, briefly, the bearing of these facts on his previous



atomic conceptions (Abstr., 1904, ii, 553). The most important idea in the new conception of molecular dynamics appears to be that which attributes the energy to the gyrational and not the translational velocity (Abstr., 1904, ii, 553).

L. M. J.

**Fusibility of Mixtures of Antimony Sulphide with Cuprous Sulphide and Mercuric Sulphide.** HENRI PÉLABON (*Compt. rend.*, 1905, 140, 1389—1392. Compare Abstr., 1904, ii, 42).—The freezing point of fused antimony sulphide ( $555^{\circ}$ ) is uniformly lowered on addition of increasing quantities of cuprous sulphide, until at  $498^{\circ}$  a eutectic point is reached, the fused mass at this temperature containing 11.0 per cent. of cuprous sulphide. On further addition of cuprous sulphide, the freezing point rises regularly at first, but the phenomena of solidification assume a somewhat complicated character when the proportion of cuprous sulphide is considerable. The process of solidification in the case of mixtures containing more than two molecules of cuprous sulphide per molecule of antimony sulphide begins at a temperature which is higher the greater the proportion of cuprous sulphide present, but in all cases the temperature at which solidification is complete is  $570^{\circ}$ , provided the molecular ratio of cuprous sulphide to antimony sulphide does not exceed ten. The observations are rendered difficult in consequence of supercooling phenomena.

The freezing point curve for mixtures of antimony and mercuric sulphides consists of two simple branches melting at a eutectic point at  $455^{\circ}$ . The eutectic mixture contains 34 per cent. of mercuric sulphide. On account of the volatilisation of the mercuric sulphide, it was not possible to study the behaviour of mixtures containing more than 68 per cent. of it. The molecular lowering of the freezing point is calculated from the data. Extrapolating to zero concentration, the data for cuprous sulphide give 797, those for mercuric sulphide give 788 (compare Guinchant and Chrétien, Abstr., 1904, ii, 538).

H. M. D.

**Relative Value of the Calorimetric Methods used in the Determination of the Heat of Combustion of Volatile Organic Substances.** JULIUS THOMSEN (*Zeit. physikal. Chem.*, 1905, 51, 657—672).—The methods used in determining the heat of combustion of organic substances are practically two in number. One of these is the author's, in which provision is made for the normal and regular combustion of the substance (as gas or vapour) in oxygen under the ordinary pressure; the other is Berthelot's method, which involves the rapid, often explosive, combustion of the substance with highly compressed oxygen in the so-called calorimetric bomb. Stress is laid on the regular character of the combustion in the first case, and on the irregular character of the combustion in the second. It is not matter for surprise, therefore, that the results obtained by the two methods exhibit considerable differences, and according to the author it is the faultiness of Berthelot's method which is responsible for this. In order to study the relation of heats of combustion to

constitution, the experimental data throughout must be of the same degree of accuracy, since the change in the heat of combustion corresponding with a change in the molecular structure is simply the difference of two experimental values. When this is recognised, less dependence will be placed on the data quoted by Berthelot, for these have been obtained partly by himself, partly by his pupils and other workers; there is therefore no guarantee for the equal level of accuracy of these data. All the data used by the author, on the other hand, are the result of his own personal observations and measurements.

Apart from these general considerations, a comparative study of the numerical data obtained by the two methods shows clearly the inferiority of Berthelot's method. This comparison is made (1) on hydrocarbons, which always form the starting point in the study of heats of combustion as related to constitution, and present no experimental difficulties; (2) on halogen compounds, which do present certain difficulties, and are therefore specially suitable for determining the relative value of the two methods. The author's data all refer to the gaseous condition of the substance; only the comparatively few, therefore, of Berthelot's data which refer to the same condition are comparable with the author's numbers.

I. Hydrocarbons. It may be shown that the heat of combustion of methane is increased by the same amount for each successive replacement of hydrogen by the methyl group, as will be seen from the following table:

Hydrocarbon.	Molecular formula.	Heat of combustion at constant volume.	Difference.
Methane .....	$\text{CH}_4$	210.77 Cal.	—
Ethane .....	$\text{CH}_3\cdot\text{CH}_3$	368.99 „	158.22
Propane .....	$\text{CH}_3(\text{CH}_3)_2$	527.47 „	158.35
Trimethylmethane .....	$\text{CH}(\text{CH}_3)_3$	685.16 „	158.13
Tetramethylmethane ...	$\text{C}(\text{CH}_3)_4$	844.79 „	158.50

It follows from the foregoing that the four valencies of the carbon atom are of equal value, and hence the relation between the heat of combustion of the molecule  $\text{C}_a\text{H}_{2b}$ , and its constitution may be expressed by the formula

$$f\text{C}_a\text{H}_{2b} = ax + 2by - \Sigma v \quad \dots\dots\dots (1),$$

in which  $x$  is the heat of combustion of each carbon atom of a gaseous compound,  $y$  is the heat of combustion of each hydrogen atom linked to carbon, and  $\Sigma v$  is the influence of all carbon linkings on the magnitude of the heat of combustion. Further, if  $p_1$ ,  $p_2$ , and  $p_3$  represent the numbers of single, double, and triple linkings respectively, and  $v_1$ ,  $v_2$ ,  $v_3$  represent the heat effects corresponding with single, double, and triple linkings, then

$$\Sigma v = p_1v_1 + p_2v_2 + p_3v_3 \quad \dots\dots\dots (2).$$

Evidently also:

$$2a - b = p_1 + 2p_2 + 3p_3 \quad \dots\dots\dots (3),$$

whence, combining equations (1), (2), and (3), it follows that

$$fC_aH_{2b} = a(x - 2v_1) + b(2y + v_1) + p_2(2v_1 - v_2) + p_3(3v_1 - v_3) \dots (4).$$

Since the quantities within brackets are constants, this equation may be written also :

$$fC_aH_{2b} = a.A + b.B + p_2.P_2 + p_3.P_3 \dots (5).$$

The exact values of  $A$ ,  $B$ ,  $P_2$ , and  $P_3$  can be deduced from the experimental data. Thus, from the foregoing table it is found that  $A = 105.92$  Cal. and  $B = 52.40$  Cal., and, from the heats of combustion of hydrocarbons with double and triple bonds, it is similarly found that  $P_2 = 16.15$  Cal. and  $P_3 = 44.37$  Cal. The following table gives the heats of combustion of a number of hydrocarbons calculated by the formula (5), and alongside of these the experimental values obtained by the author and by Berthelot respectively, with the corresponding differences between calculated and observed values :

*Heat of Combustion of Gaseous Hydrocarbons at Constant Volume.*

Hydrocarbon.	$C_aH_{2b}$ .	Calculated.		Thomsen.		Berthelot.	
		Cal.		Cal.	Diff.	Cal.	Diff.
Methane .....	$CH_4$	210.7		210.8	+0.1	212.3	+1.6
Ethane .....	$C_2H_6$	369.0		369.0	$\pm 0.0$	370.8	+1.8
Propane .....	$C_3H_8$	527.4		527.5	+0.1	526.7	-0.7
Trimethylmethane ...	$C_4H_{10}$	685.7		685.2	-0.5	—	—
Tetramethylmethane .	$C_5H_{12}$	844.0		844.8	+0.8	—	—
Ethylene.....	$C_2H_4$	332.8		332.2	-0.6	339.9	+7.1
Propylene ...	$C_3H_6$	491.1		491.3	+0.2	497.8	+6.7
isoButylene .....	$C_4H_8$	649.4		648.9	-0.5	—	—
Diallyl .....	$C_6H_{10}$	929.8		930.8	+1.0	902.3	-27.5
Acetylene .....	$C_2H_2$	308.6		309.2	+0.6	314.8	+6.2
Allylene.....	$C_3H_4$	466.9		466.4	-0.5	471.8	+4.9
Dipropargyl .....	$C_6H_8$	881.5		881.4	-0.1	852.1	-29.4

The table shows clearly the high relative accuracy of the author's data and the great irregularity of the data communicated by Berthelot. It is impossible to bring the latter's values for the heats of combustion of diallyl and dipropargyl into harmony with those for other hydrocarbons with double or triple linkings. Again, Berthelot's values for the heats of combustion of diallyl and dipropargyl are about 3 per cent. less than the author's values, whilst Berthelot's values for ethylene, propylene, acetylene, and allylene are 1—2 per cent. higher than the author's values. The great relative accuracy of the latter is further demonstrated in the following table, in which are compared the heats of combustion of carbon compounds differing from each other only by one atom of carbon :



Substance	Molecular formula.	Heat of combustion.	Difference.
Ethylene.....	$C_2H_4$	332.2 Cal. }	121.4 Cal.
Methane .....	$CH_4$	210.8 „ }	
Propylene .....	$C_3H_6$	491.3 „ }	122.3 „
Ethane .....	$C_2H_6$	369.0 „ }	
<i>iso</i> Butylene .....	$C_4H_8$	648.9 „ }	121.4 „
Propane .....	$C_3H_8$	527.5 „ }	
Chloroethylene .....	$C_2H_3Cl$	297.6 „ }	121.4 „
Methyl chloride .....	$CH_3Cl$	176.2 „ }	
Allyl chloride .....	$C_3H_5Cl$	453.7 „ }	120.6 „
Ethyl chloride .....	$C_2H_5Cl$	333.1 „ }	
Allyl bromide .....	$C_3H_5Br$	461.1 „ }	120.3 „
Ethyl bromide .....	$C_2H_5Br$	340.8 „ }	
Allyl methyl ether .....	$C_3H_5 \cdot O \cdot CH_3$	625.7 „ }	121.3 „
Ethyl methyl ether.....	$C_2H_5 \cdot O \cdot CH_3$	504.4 „ }	

The corresponding differences deduced from Berthelot's values for (1) ethylene and methane, (2) propylene and ethane, are 127.6 and 127.0 Cal.

It appears, therefore, that Berthelot's values for the heats of combustion of the olefines are about 6 Cal. too high; his values also for acetylene and allylene are found to be too high. The very unequal accuracy of Berthelot's data is especially evident in the case of these unsaturated hydrocarbons, for they tend to burn with a smoky flame, and it is only when care is taken, as in the author's method of working, to make their combustion regular and complete that satisfactory results can be obtained; for the regularity and completeness of the combustion by Berthelot's explosive method, there is no guarantee.

Again, in the author's data, there is a regular difference between the heat of combustion of an ethyl compound and that of the corresponding phenyl compound, as shown in the following table:

Compound.	Heat of combustion.	Difference.
$C_6H_5 \cdot H$	797.9 Cal. }	428.9 Cal.
$C_2H_5 \cdot H$	369.0 „ }	
$C_6H_5 \cdot OH$	767.6 „ }	428.3 „
$C_2H_5 \cdot OH$	339.4 „ }	
$C_6H_5 \cdot O \cdot CH_3$	934.8 „ }	430.4 „
$C_2H_5 \cdot O \cdot CH_3$	504.4 „ }	
$C_6H_5 \cdot Cl$	762.9 „ }	429.8 „
$C_2H_5 \cdot Cl$	333.1 „ }	

Berthelot's value for the heat of combustion of benzene is 782.6 Cal., and the difference between the values for benzene and ethane is 411.8 Cal.

II. Halogen compounds. The differences between Berthelot's and the author's numbers for the heats of formation of halogen compounds are so great that either one or other of the two series of data must be entirely valueless. In the author's method for the combustion of these substances (see details in "Thermochemische Untersuchungen," II, 339—364, and IV, 77—127), the results were checked by an estimation of carbon dioxide, halogen hydride, and free halogen in the combustion products. In the experiments of Berthelot and his pupils, on the other hand, the halogen compound has simply been burned in the calorimetric bomb, often with the addition of camphor; in this case,

there is no guarantee that the process of combustion has been a normal one. The following table gives an idea of the differences in the results obtained. The values given in the table are the heats of formation at constant volume from amorphous carbon and gaseous chlorine, bromine, or iodine. The direct experimental data given by Berthelot refer to carbon as diamond and to constant pressure: these original values have therefore been suitably corrected to make them strictly comparable with the author's:

*Heats of Formation of Halogen Compounds (in Form of Gas or Vapour)  
at Constant Volume.*

Substance.	Molecular formula.	Berthelot.	Thomsen.
Methyl chloride .....	$\text{CH}_3\text{Cl}$	30.1 Cal.	21.97 Cal.
Ethyl    ,,        .....	$\text{C}_2\text{H}_5\text{Cl}$	41.5   ,,	29.55   ,,
Propyl   ,,        .....	$\text{C}_3\text{H}_7\text{Cl}$	—	36.02   ,,
<i>iso</i> Butyl   ,,        .....	$\text{C}_4\text{H}_9\text{Cl}$	—	43.05   ,,
Amyl    ,,        .....	$\text{C}_5\text{H}_{11}\text{Cl}$	50.1   ,,	50.18   ,, (Calcd.)
Chloroethylene .....	$\text{C}_2\text{H}_3\text{Cl}$	—	- 2.46   ,,
Chloropropylene .....	$\text{C}_3\text{H}_5\text{Cl}$	—	+ 7.25   ,,
Allyl chloride .....	$\text{C}_3\text{H}_5\text{Cl}$	—	+ 5.94   ,,
Phenyl   ,,        .....	$\text{C}_6\text{H}_5\text{Cl}$	—	- 12.38   ,,
Ethylene chloride.....	$\text{C}_2\text{H}_4\text{Cl}_2$	—	+ 33.12   ,,
Ethylidene   ,,        .....	$\text{C}_2\text{H}_4\text{Cl}_2$	37.3   ,,	33.07   ,,
Chloroacetal .....	$\text{C}_3\text{H}_6\text{Cl}_2$	—	40.34   ,,
Methylene chloride .....	$\text{CH}_2\text{Cl}_2$	32.8   ,,	—
Chloroform .....	$\text{CHCl}_3$	48.3   ,,	23.53   ,,
Chloroethylene chloride.	$\text{C}_2\text{H}_3\text{Cl}_3$	—	32.83   ,,
Tetrachloromethane... ..	$\text{CCl}_4$	70.6   ,,	20.45   ,,
Tetrachloroethylene.....	$\text{C}_2\text{Cl}_4$	49.6   ,,	(liq.) - 1.73   ,,
Hexachloroethane.....	$\text{C}_2\text{Cl}_6$	106.3   ,,	(cryst.) —
Methyl bromide .....	$\text{CH}_3\text{Br}$	18.4   ,,	+ 14.21   ,,
Ethyl    ,,        .....	$\text{C}_2\text{H}_5\text{Br}$	34.1   ,,	21.84   ,,
Propyl   ,,        .....	$\text{C}_3\text{H}_7\text{Br}$	—	29.11   ,,
Allyl    ,,        .....	$\text{C}_3\text{H}_5\text{Br}$	—	- 1.50   ,,
Methyl iodide .....	$\text{CH}_3\text{I}$	17.0   ,,	+ 2.84   ,,
Ethyl    ,,        .....	$\text{C}_2\text{H}_5\text{I}$	26.5   ,,	9.93   ,,
Methane .....	$\text{CH}_4$	19.6   ,,	21.17   ,,
Ethane .....	$\text{C}_2\text{H}_6$	25.5   ,,	27.40   ,,
Ethylene .....	$\text{C}_2\text{H}_4$	- 11.0   ,,	- 3.29   ,,

The heats of formation of methane, ethane, and ethylene are added to the table for the sake of comparison. If the monochloro-derivatives of the paraffins are first considered, the author's values in the foregoing table show that, as usual in a homologous series, there is a simple relationship between the heat of formation of the molecule and its constitution. The heat of formation of the gaseous compound,  $\text{C}_a\text{H}_{2a+1}\text{Cl}$ , from amorphous carbon, gaseous hydrogen and chlorine is given by the formula:  $(\text{C}_a\text{H}_{2a+1}\text{Cl}) = 15.13 \text{ Cal.} + a. 7.01 \text{ Cal.}$  The difference between the values calculated by this formula and the author's values for methyl, ethyl, propyl, and *isobutyl* chlorides does not exceed in any case 0.1 per cent. of the corresponding heat of combustion. The differences between Berthelot's and the author's values for methyl and ethyl chlorides are about 8 and 12 Cal. respectively. It is noteworthy that the only value given by Berthelot (that for amyl

chloride) which agrees with the calculated value was not the result of a determination in the calorimetric bomb.

According to the author's data, there is a constant difference between the heats of formation of corresponding chlorides, bromides, and iodides. The unequal accuracy of Berthelot's data is evidenced by the fact that his values exhibit no such regularity, as may be seen from the following :

	Methyl.	Ethyl.	Propyl.	Allyl.		
Chloride-Bromide {	7·76	7·71	6·91	7·44	Cal....	Thomsen
	11·7	7·4	—	—	,, ...	Berthelot
Bromide-Iodide {	11·37	11·91	—	—	,, ...	Thomsen
	1·4	7·6	—	—	,, ...	Berthelot

The difference between the heats of formation of neighbouring members of homologous series should be approximately a constant, but this is the case only with the author's data :

	Chloride.	Bromide.	Iodide.		
Ethyl-Methyl {	7·6	7·6	7·1	Cal. ....	Thomsen
	11·4	15·7	9·5	,, .....	Berthelot

It may further be shown, as follows, that the author's values for the heats of formation of two analogous compounds, the molecules of which differ only by one carbon atom, exhibit a regular difference :

Chloroethylene-methyl chloride.....	-24·4 Cal.
Chloropropylene-ethyl chloride .....	-22·3 ,,
Allyl chloride-ethyl chloride .....	-23·6 ,,
Tetrachloroethylene-tetrachloromethane .....	-22·2 ,,

A very important criterion of the accuracy of Berthelot's data is found in a comparison of the heats of formation of methane and of its chlorine derivatives :

Substance.	Molecular formula.	Heat of formation at constant volume.	
		Thomsen.	Berthelot.
Methane .....	CH <sub>4</sub>	21·2 Cal.	19·6 Cal. } 10·5
Methyl chloride .....	CH <sub>3</sub> Cl	22·0 ,,	30·1 ,, } 2·7
Methylene chloride ..	CH <sub>2</sub> Cl <sub>2</sub>	—	32·8 ,, } 15·5
Chloroform .....	CHCl <sub>3</sub>	23·5 ,,	48·3 ,, } 22·3
Tetrachloromethane.	CCl <sub>4</sub>	20·5 ,,	70·6 ,, }

It will be seen that, according to the author's results, chlorine and hydrogen exert a practically equal influence on the heat of formation of the molecule, whereas Berthelot's results indicate that the heat effect associated with the linking of chlorine to carbon is considerably greater than that associated with the linking of hydrogen to carbon. But it will be noted how very irregular is the increase in Berthelot's figures corresponding with the successive introduction of chlorine ; the replacement of the first half of the hydrogen in methane by chlorine raises the heat of formation 13·2 Cal. ; the similar replacement of the second half of the hydrogen raises the heat of formation further by



37.8 Cal. Similar irregularities are found in Berthelot's figures for the heats of formation (1) of ethane and its chlorine derivatives, (2) of ethylene and its chlorine derivatives. Thus, according to his figures, the introduction of the first chlorine atom in ethane *raises* the heat of formation by 16.0 Cal.; the introduction of the second chlorine atom gives a value 4.2 Cal. *below* that for ethyl chloride. In these cases, as also for benzene (heat of formation = -13.7 Cal.) and chlorobenzene (heat of formation = -12.4 Cal.), the author's data all support the view that chlorine and hydrogen exert an approximately equal influence on the heat of formation of the molecule.

Summing up, the author insists again on the high relative accuracy of his own data and their suitability for the development of relationships between heat of combustion and constitution. Berthelot's data, on the other hand, are so irregular and of such low relative accuracy that they are quite useless for any such purpose, and theoretical investigations (Lemoult, *Abstr.*, 1904, ii, 310; Lagerlöf, *ibid.*, 382, 605; this vol., ii, 76) based on these data lead to entirely wrong conclusions.

J. C. P.

**General Relations between the Heats of Combustion of Organic Compounds and their Constitutional Formulæ. Calculation of the Heats of Combustion. Part II.** PAUL LEMOULT (*Ann. Chim. Phys.*, 1905, [viii], 4, 5—70).—The application of the author's methods of calculating the heats of combustion of organic substances (*Abstr.*, 1903, ii, 410; 1904, ii, 12, 310) to the various classes of nitrogen, halogen, and sulphur compounds is considered. The results recorded have already been published (*Abstr.*, 1904, ii, 382: amines, amides, imides, nitriles, and heterocyclic compounds with nitrogen in the ring; *Abstr.*, 1904, ii, 605: sulphur and halogen compounds; *Abstr.*, 1904, ii, 805: miscellaneous). The "calculated" and "experimental" heats of combustion for a very large number of compounds of these classes are tabulated in the original, and these tables show the general agreement existing between the two sets of numbers.

T. A. H.

**Thermochemical Investigation of Strychnine and Brucine.** MARCELLIN BERTHELOT and GAUDECHON (*Ann. Chim. Phys.*, 1905, [viii], 5, 145—165).—A *résumé* of work already published (compare this vol., ii, 301).

M. A. W.

**Determination of Vapour Densities at High Temperatures. II. Vapour Density of Carbon Dioxide at 2000°.** FRIEDRICH EMICH (*Monatsh.*, 1905, 26, 505—523. Compare *Abstr.*, 1904, ii, 14).—By means of the apparatus described in the previous paper, the author has compared the rate of flow of carbon dioxide with that of nitrogen at the ordinary temperature and at 2000°. The results show that at 2000° carbon dioxide is not, or is only slightly, dissociated (compare Le Chatelier, *ibid.*, 1889, 205; Hahn, *ibid.*, 1903, ii, 711; Jüptner, *ibid.*, 1904, ii, 382).

The crumbling of the edges and consequent enlargement of the opening of the iridium tubes is diminished by coating the tubes with a thin layer of zirconium and yttrium oxides. The temperature of

such glazed tubes, equally with that of the unglazed iridium, can be determined with sufficient accuracy by the optical pyrometer.

G. Y.

**New Apparatus for the Determination of Vapour Density.** E. GRIMSEHL (*Zeit. angew. Chem.*, 1905, 18, 734—735).—The author describes a form of apparatus for the rapid determination of vapour densities. The substance is vaporised in a tube about 130 cm. long, surrounded by a vapour jacket. Towards the upper end, this tube is open to the atmosphere, below it communicates by a 3-way stopcock with a delicate manometer consisting of two wide tubes connected with one another by a narrow bore tube, the whole containing coloured water with an air bubble as index in the horizontal tube. By this means, the difference of level is magnified about 50 times. When the tube is full of vapour, it is placed in communication with the manometer, the reading of which gives the difference between the weight of the column of vapour and that of a column of air of equal height, from which the vapour density is readily obtained.

L. M. J.

**Calculation of the Exact Molecular Weights of the Easily Liquefiable Gases from their Densities; Atomic Weights of Hydrogen, Nitrogen, Argon, Chlorine, Sulphur, and Carbon.** PHILIPPE A. GUYE (*Compt. rend.*, 1905, 140, 1241—1243. Compare Abstr., 1904, ii, 475).—The relationship  $M/L(1+a)(1-b) = 22.412$ , in which  $M$  is the molecular weight,  $L$  the weight of a litre of the gas in the normal state, and  $a$  and  $b$  the constants calculated from the critical data, is not satisfied by the more easily condensible gases. The deviations are due to the fact that the values of  $a$  and  $b$  for the critical state differ from the values for the normal condition. The correct values for the normal condition of the gas have been deduced, and the following molecular weights, referred to  $O_2 = 32.000$  as basis, have been calculated:  $CO_2$ , 44.003;  $N_2O$ , 44.000;  $SO_2$ , 64.065;  $HCl$ , 36.484;  $C_2H_2$ , 26.018. From these, the atomic weights of the contained elements are deduced. The numbers given are: hydrogen, 1.0077; carbon, 12.002; nitrogen, 14.007; chlorine, 35.476; sulphur, 32.065; and argon, 39.866. Except in the case of nitrogen, these values agree well with the numbers in the international table.

H. M. D.

**Atomic Weight of Nitrogen deduced from the Ratio of the Densities of Nitrogen and Oxygen.** PHILIPPE A. GUYE (*Compt. rend.*, 1905, 140, 1386—1388. Compare preceding abstract).—If  $d_1$  and  $d_2$  are the densities of two gases measured at corresponding temperatures  $T_1$  and  $T_2$ , and under corresponding pressures  $p_1$  and  $p_2$ , and if the molecular weights of the gases are  $M_1$  and  $M_2$ , then, according to the theory of corresponding states,  $d_1/d_2 = M_1 p_1 T_2 / M_2 p_2 T_1$ , or  $M_1/M_2 = (d_1 T_1 / p_1) / (d_2 T_2 / p_2)$ . The ratio of the densities of the two gases, measured at corresponding temperatures and pressures, when reduced to the normal state ( $0^\circ$  and 760 mm.) should therefore give the ratio of the molecular or atomic weights.

When the corresponding temperatures and pressures are so chosen that the interpolation involved in the reduction is a minimum (oxygen,

100° and 760 mm., nitrogen, 37° and 505 mm.), the number deduced for the atomic weight of nitrogen is 14.014.

According to Berthelot, the two gases satisfy the simple laws with greatest exactitude at a temperature equal to  $2.45 \times$  critical temperature. If these (oxygen 105°, nitrogen 40°) are taken as the corresponding temperatures, and the pressure in each case is taken as 760 mm., the atomic weight deduced is 14.011.

These numbers are compared with others obtained from density measurements by using other reduction methods, and 14.009 is considered to be the most probable value of the atomic weight of nitrogen according to density determinations.

H. M. D.

**Molecular Attraction. IV. Biot's Formula for Vapour Pressure and Some Relations at the Critical Temperature.** JAMES E. MILLS (*J. Physical Chem.*, 1905, 9, 402—417. See this vol., ii, 152).—The combination of Crompton's equation for the latent heat of vaporisation with the ordinary thermodynamical equations leads to the expression  $dP/dT = 2R/v$  at the critical temperature, where  $v$  is the critical volume, that is, at the critical temperature the value of  $dP/dT$  is exactly double what it would be for the perfect gas occupying the same volume. As Crompton's equation had been shown previously to give good results for the heat of vaporisation at temperatures approaching the critical temperature, the critical values for  $dP/dT$  are taken from the above expression, and shown to be in good accord with the observed values where comparison is possible—the agreement in the case of isopentane, normal pentane, and ether being within experimental errors. It is shown that in the neighbourhood of the critical temperature the Biot curve must lie below the true curve, and that no alteration of the constants will cause concordance. Employing the above relation, the values for  $\mu' [(L - E)/(\sqrt[3]{d} - \sqrt[3]{D})]$  at the critical temperature agree well with the mean values found previously. From the previous results, the author is further able to deduce the well-known relation  $D_c/d_c = \text{constant}$ , where  $D_c$  is the theoretical, and  $d_c$  the actual critical density.

L. M. J.

**Osmosis through Silica Tubes.** G. BELLOC (*Compt. rend.*, 1905, 140, 1253—1254. Compare Berthelot, this vol., ii, 316).—After exposure to high temperatures, the surface of fused silica has a milky appearance. Microscopic examination shows that the surface is considerably altered, and crystalline particles are recognisable in reflected light. The phenomenon of osmosis is perhaps connected with this process of devitrification.

H. M. D.

**Permeability of Glass Vessels.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 140, 1286—1292).—The author finds that tubes of "ordinary" white glass or of Jena glass are permeable to hydrogen, oxygen, and carbon monoxide under the conditions observed for fused silica vessels (this vol., ii, 316), but at lower temperatures. No loss was observed when wood charcoal or graphite was heated in either "ordinary" or Jena glass vessels, otherwise vacuous.

The permeability of the walls of glass or fused silica vessels to



gases is regarded as similar in character to the interchange of gases which takes place through caoutchouc or animal membranes.

T. A. H.

#### Employment of Thermal Analysis in Abnormal Cases.

GUSTAV TAMMANN (*Zeit. anorg. Chem.*, 1905, 45, 24—30).—In 1903 (Abstr., 1904, 113), the author showed how the composition of crystallised chemical compounds occurring in alloys could be established by thermal analysis. There are two chief cases, namely, (1) the compound melts to a homogeneous liquid, (2) the compound splits up at a definite temperature into another crystalline substance and a fused mass. Under the second head, certain complications may occur during the cooling of the fused alloy; it is shown in detail that the complications do not invalidate the method.

D. H. J.

#### Determination of Chemical Equilibrium from Explosion Processes. I. K. FINCKH (*Zeit. anorg. Chem.*, 1905, 45, 116—126).

—When electrolytic gas mixed with air is exploded under different conditions, it is found that the proportion of nitric oxide (NO) present after the explosion depends on the temperature and pressure (concentration) of the admixed electrolytic gas. It is clear then that the equilibrium which exists at the moment of the explosion cannot be deduced from the final equilibrium after cooling, and that the law of mass action cannot be applied directly. An experimental attempt was made to arrive at the same conclusion in the case of the formation of hydrogen peroxide by the explosion of hydrogen with an excess of oxygen; here the amount of peroxide obtained is much smaller than that corresponding with chemical equilibrium.

D. H. J.

#### Determination of Chemical Equilibrium from Explosion Processes. II. WALTHER NERNST (*Zeit. anorg. Chem.*, 1905, 45, 126—131).

—With reference to Finckh's work (preceding abstract), the author points out that it would be difficult to calculate in general the displacement of the chemical equilibrium in explosion processes, but suggests that it would be possible to give a mathematical treatment in the case where (as in the formation of nitric oxide by the explosion of electrolytic gas mixed with air) the velocity of the reaction is not sufficiently great to allow of the establishment of equilibrium at the moment of the explosion. When applied to Finckh's experimental data, this suggestion gives satisfactory results. Another method of ascertaining chemical equilibrium depends on the measurement of the maximum pressure of the explosion; some applications of this method were given by Mallard and Le Chatelier (*Ann. Mines*, 1883, 8, 4).

D. H. J.

**Equilibria in the Systems:**  $\text{TlNO}_3\text{—KNO}_3$ ,  $\text{TlNO}_3\text{—AgNO}_3$ , and  $\text{TlNO}_3\text{—NaNO}_3$ . CORNELIS VAN ELJK (*Zeit. physikal. Chem.*, 1905, 51, 721—731).—(1)  $\text{TlNO}_3\text{—KNO}_3$ .—By way of supplement and correction to the previous paper on this subject (Abstr., 1900, ii, 133), it is stated that thallium nitrate solidifies in regular crystals, which are stable down to  $142.5^\circ$ : between  $142.5^\circ$  and  $72.8^\circ$ , the

rhombohedric modification is the stable one; below  $72.8^\circ$ , the rhombic modification. The latter transition point can easily be overlooked, since the transition process is very sluggish. The transition of the rhombohedric mixed crystals containing from 100—81 molecular per cent. of thallium nitrate takes place at temperatures rising gradually from  $72.8^\circ$  to  $78^\circ$ .

(2)  $\text{TlNO}_3\text{—AgNO}_3$ .—The substance of this communication has been already reported (Abstr., 1900, ii, 403).

(3)  $\text{TlNO}_3\text{—NaNO}_3$ .—The freezing point of thallium nitrate is  $206.1^\circ$ , that of sodium nitrate is  $308^\circ$ ; the freezing point curve for mixtures of the two salts is of the simplest type, with a eutectic point at  $162^\circ$ . There is no evidence of the formation of a double salt. Further, the transition temperatures of thallium nitrate are not altered by the addition of sodium nitrate, hence no mixed crystals are formed.

J. C. P.

**Equilibrium between Acetone and Hydroxylamine Hydrochloride.** PHILIPPE LANDRIEU (*Compt. rend.*, 1905, 140, 1392—1393. Compare Francesconi and Milesi, Abstr., 1902, i, 660).—When acetone and hydroxylamine hydrochloride are brought together in aqueous solution in molecular proportions, a state of equilibrium is established, which can be represented by



The value of  $x$  has been determined for a series of concentrations by measuring the heat developed on addition of excess of sodium hydroxide to the solution. If this be denoted by  $Q$ , and if  $Q_1$  and  $Q_2$  are the quantities of heat developed when excess of the alkali is added respectively to acetone and hydroxylamine hydrochloride and to acetoxime hydrochloride, then  $x = (Q_1 - Q)/(Q_1 - Q_2)$ . The following numbers were obtained:

Litres per gram-mol.	4	6	8	12	24	48
$Q_1$ .....	—	—	23.13	25.19	26.06	28.52
$Q_2$ .....	18.21	20.77	21.15	22.20	24.52	—
$Q$ .....	19.04	21.66	22.25	23.30	25.99	—
$x$ .....	0.84	0.80	0.75	0.72	0.63	—

The values of  $x$  thus found are in agreement with the requirements of the law of mass action.

H. M. D.

**Approximate Composition of the Hydrates formed by Certain Electrolytes in Aqueous Solutions at Different Concentrations.** X. HARRY C. JONES and H. P. BASSETT (*Amer. Chem. J.*, 1905, 33, 534—586. Compare Abstr., 1904, ii, 386, 710, and previous abstracts).—A series of curves based on data published in earlier papers has been constructed in order to exhibit the relation between the water of crystallisation of certain electrolytes and the depression of the freezing point of their aqueous solutions. The relations thus shown afford conclusive evidence of the existence of hydrates in the solutions.

Experiments have been carried out with the object of obtaining the data required for calculating the approximate composition of the hydrates formed at various concentrations. The depression of the freezing point, the conductivity at  $0^{\circ}$ , and the sp. gr. have been determined of solutions of different concentrations of calcium chloride and bromide, strontium bromide, barium bromide, magnesium chloride and bromide, manganese chloride and nitrate, cobalt chloride and nitrate, nickel chloride and nitrate, copper chloride and nitrate, and sulphuric acid. The results are tabulated and are also plotted as curves.

From an examination of these results, it is evident that the amount of water combined with the dissolved substance increases regularly as the concentration of the solution increases. In some cases, the number of mols. of water combined with 1 mol. of the dissolved substance increases from the most concentrated to the most dilute solution, whilst in other cases it either passes through a maximum or attains a maximum value which remains practically constant as the dilution is further increased.

E. G.

**Liquid Hydrogen Sulphide as a Solvent.** UBALDO ANTONY and G. MAGRI (*Gazzetta*, 1905, **35**, i, 206—226).—The characters exhibited by liquid hydrogen sulphide differ widely from those of the gas. When quite pure, the liquid can be kept in Dewar's vacuum vesse's isolated from external moisture; it undergoes slow evaporation, which is accelerated by the addition of pieces of pumice, &c. It has a neutral reaction to litmus paper, owing either to the non-dissociation of the hydrogen sulphide or to the inactivity of the litmus at the low temperature of the liquid. Electrically, liquefied hydrogen sulphide acts as an insulator, and in the neighbourhood of its boiling point it does not exhibit in its chemical behaviour that analogy with water which would be expected from its chemical composition. As a solvent, it behaves to some extent similarly to carbon disulphide, alcohol, ether, or benzene, but although its solvent powers are relatively extended, its ability to cause dissociation is far less marked than that of water and other strongly dissociating solvents. The salts of energetic bases are not soluble in it, but non-metallic compounds are dissolved by it, giving conducting solutions. Iodine, when dissolved in liquid hydrogen sulphide, bestows on it very considerable conductivity; phosphorus iodide has the same effect to a less degree, and the haloid compounds of the other non-metals, although they dissolve in very small proportions, give solutions of moderate conductivity. Solutions of certain organic substances, for example, iodoform and tetramethylammonium iodide, yield solutions having conductivities which indicate that organic compounds may become ionised in liquid hydrogen sulphide.

The nitro-derivatives of benzene, nitronaphthalene, and naphthylamine dissolve moderately well in this solvent, but the solutions are non-conducting; there is a marked difference between the solubility of picric acid and that of potassium picrate.

Most of the above-mentioned compounds dissolve in liquid hydrogen sulphide with absorption of heat, but exceptions to this rule are met with in phosphorus trichloride and tribromide.



Hydrocarbons, alcohols, ethers, &c., also dissolve in liquid hydrogen sulphide.

The marked chemical activity of hydrogen sulphide in the state of gas or in aqueous solution vanishes almost entirely when the gas is liquefied. Thus, iodine reacts but very slightly with liquid hydrogen sulphide, but gives a dark red solution; also, liquid sulphur dioxide and liquid hydrogen sulphide mix, but only react readily in presence of an ionising liquid. Salts of copper, lead, &c., are unchanged by liquid hydrogen sulphide, and the same is the case with powerful oxidising agents such as chromium trioxide, chromates, dichromates, permanganates, &c. Concentrated sulphuric acid and Nordhausen acid are both solidified in liquid hydrogen sulphide, but do not react with it. Sodium and potassium remain unchanged in the liquid, and mercury solidifies in it without exhibiting any superficial alteration. Bromine, even in the solid condition, reacts energetically with liquid hydrogen sulphide, forming sulphur bromide.

Iodine and liquid hydrogen sulphide do not react when dissolved in ordinary solvents, such as the lower aliphatic hydrocarbons, carbon disulphide, or chloroform. Nor does the presence of thiophen determine any reaction, but decane, carvene, amylene, and benzene do so, various products being obtained. More marked in their power to cause interaction between iodine and liquid hydrogen sulphide are hydroxylated compounds, and the same is the case with aldehydes and ketones; indeed, benzaldehyde alone reacts with the liquid sulphide.

Attention is called to the papers by McIntosh and Steele (*Abstr.*, 1904, ii, 533) and Archibald and McIntosh (*Abstr.*, 1904, ii, 534) on this subject.

Descriptions, with illustrations, are given of the apparatus used for the preparation, purification, and liquefaction of the hydrogen sulphide and for the conductivity measurements.

T. H. P.

#### Influence of Alkaloids and Alkaloidal Salts on Catalysis.

ORVILLE H. BROWN and C. HUGH NEILSON (*Amer. J. Physiol.*, 1905, 13, 427—435).—The action of strychnine, caffeine, and their salts on the hydrolysis of hydrogen peroxide by platinum black and by aqueous extracts of kidney or pancreas has been examined. The results are given in tabular form, and show that the action exhibited is almost always inhibitory, some salts being more active in this direction than others. The salts of hydrochloric, hydrobromic, and nitric acids invariably retard the catalysis whether the base is an alkaloid or a metal. In the case of other salts, the result is either less marked, or occasionally a slight stimulating effect is noticeable with certain concentrations.

W. D. H.

**Theory of Colloids.** KARL LANDSTEINER (*Zeit. physikal. Chem.*, 1905, 51, 741—742).—The author draws attention to earlier work by himself and Jagič, to which Billitzer (this vol., ii, 305) has made inadequate reference.

J. C. P.

**Theory of Colloids.** EDUARD JORDIS (*Zeit. Elektrochem.*, 1905, 11, 288—290).—Mainly a claim for priority.

T. E.

**The Unit of Combining Weights.** ROBERT LUTHER (*Zeit. Elektrochem.*, 1905, 11, 273).—The chemical combining weights might be brought into harmony with the C.G.S. system of physical units (by means of Faraday's law) by defining the combining weight of a univalent element as the quantity corresponding with  $10^4$  electromagnetic units of electricity. This quantity of electricity is very nearly 100,000 coulombs, and the combining weights so defined would therefore be about 3.5 per cent. larger than those at present in use.

T. E.

**The Conception of Valency.** JEAN BILLITZER (*Zeit. anorg. Chem.*, 1905, 45, 81—82).—In answer to Abegg and Hinrichsen, the author emphasises the distinction between total affinity and valence affinity (*Abstr.*, 1904, ii, 32, 475, 720; this vol., ii, 155).

D. H. J.

**A Simple Gas Pressure Regulator.** J. MAREK (*J. pr. Chem.*, 1905, [ii], 71, 431—432).—Two forms of a simple gas pressure regulator, which can be set up with ordinary laboratory apparatus, are described and illustrated.

G. Y.

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## Inorganic Chemistry.

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**Chemical Combination of Oxygen and Hydrogen under the Action of Radium Rays.** BERGER DAVIS and C. W. EDWARDS (*J. Soc. Chem. Ind.*, 1905, 24, 266—267).—When a radium salt is dissolved in water, hydrogen is continuously liberated; the authors have now been able to obtain the reverse effect, that is, the synthesis of water, by exposing a mixture of hydrogen and oxygen to the action of radium bromide. By determining the contraction in volume of the mixed gases on removing the water by means of phosphoric oxide, and the amount of ionisation as measured by an electrometer, 13,100 molecules of water are found to be formed for each free ion produced; the ratio increases with increase of temperature.

P. H.

**The Mechanics of Fire.** HENRY E. ARMSTRONG (*J. Soc. Chem. Ind.*, 1905, 24, 473—480).—The paper contains a comprehensive summary of the author's views on the mechanism of the process of oxidation, most of which have been already published elsewhere (compare *Trans.*, 1903, 83, 1088).

The subject is treated under the following heads:—Combustion of Hydrogen. Hydrocarbons. Carbon monoxide and carbon. The Retardation of combustion by oxygen. Autoxidation. It is illustrated with numerous diagrams and tables, for details of which the original paper should be consulted.

P. H.

**Action of the Silent Discharge on Chlorine.** G. W. A. FOSTER (*Ber.*, 1905, **38**, 1781—1784. Compare Russ, this vol., ii, 381).—Chlorine, after being subjected to a silent discharge, does not carry an electrical charge, nor can any change in the density of the gas be detected. The author considers that the use by Russ of benzene as a test substance for "active" chlorine is open to criticism.

W. A. D.

**Action of Oxidising Agents on Hydriodic Acid. Reactions of Hypoiodous Acid.** ANTON SKRABAL (*Chem. Zeit.*, 1905, **29**, 550—554).—By the action of an excess of an oxidising agent on dilute solutions of hydriodic acid, hypoiodous and iodic acids are formed. The colour of solutions of hypoiodous acid varies from greenish-yellow to brown according to the concentration. Dilute solutions of hypoiodous acid have the odour of iodoform, whilst more concentrated solutions, owing to their decomposition, have the odour of iodine. In acid solution, hypoiodous acid decomposes into iodine and iodic acid, a change which is accelerated by the removal of one of the products of the action by the addition of iodides, by diminishing the concentration of the hydrogen ions, or by the addition of certain reducing agents. Hypoiodous acid is probably the primary product of the oxidation of hydriodic acid.

A. McK.

**Constitution of Fremy's Sulphazilate and of Pelouze's Nitrosulphate.** EDWARD DIVERS (*Ber.*, 1905, **38**, 1874—1878).—A reply to Hantzsch's criticisms (this vol., ii, 313). The conclusions of Haga (*Trans.*, 1904, **85**, 78) and of Divers (*Proc.*, 1903, **19**, 283; *Trans.*, 1895, **67**, 1098) are upheld.

E. F. A.

**Synthesis of Hydronitric Acid [Azoimide].** ARTHUR WESLEY BROWNE (*J. Amer. Chem. Soc.*, 1905, **27**, 551—555; *Ber.*, 1905, **38**, 1825—1829).—When a solution of hydrazine sulphate in dilute sulphuric acid is treated with hydrogen peroxide, azoimide is produced, the yield under certain conditions amounting to more than 28 per cent. of that required by the equation  $3\text{N}_2\text{H}_4 + 5\text{H}_2\text{O}_2 = 2\text{N}_3\text{H} + 10\text{H}_2\text{O}$ .

It has been found that small quantities of azoimide can be also obtained by the action of other oxidising agents on hydrazine sulphate.

E. G.

**Solubility of Phosphorus in Ether and Benzene.** ANASTASIOS CHRISTOMANOS (*Zeit. anorg. Chem.*, 1905, **45**, 132—141).—The solubilities of phosphorus in ethyl ether and in benzene at various temperatures are tabulated in the original. For 100 parts of solvent, it varies in the case of ethyl ether from 0.4335 part at 0° to 1.9984 parts at 55°. In benzene, it is 1.513 parts at 0°, and increases to 10.027 at 81°.

A saturated solution of phosphorus in ether has the sp. gr. 0.7257 at 13°, 0.7187 at 19°, 0.7283 at 25°, and  $n_D$  1.3565462 at 19°, and 1.35435 at 25°. A saturated solution in benzene has  $n_D$  1.5129453 at 11.9°, 1.5107379 at 19°, and 1.50638 at 25°, and the sp. gr. 0.8959 at 13°, 0.8912 at 19°, 0.8875 at 22°, 0.8861 at 25°. The solutions of phosphorus in ether and benzene respectively differ in



appearance and in the phenomena observed on keeping or on evaporating the solutions on pieces of paper in the air or on watch-glasses.

D. H. J.

**Preparation of Diamonds.** HENRI MOISSAN (*Ann. Chim. Phys.*, 1905, [viii], 5, 174—208).—A *résumé* of work already published (compare this vol., ii, 43, 160, 166, 247).

M. A. W.

**Preparation and Purification of Carbon Tetrabromide.** A. VON BARTAL (*Chem. Zeit.*, 1905, 29, 377—378).—The yield of carbon tetrabromide by Wallach's method (*Abstr.*, 1893, i, 596) may be increased from 39 per cent. to 63 per cent. by adding 1 c.c. of acetone and 8 c.c. of bromine to a solution of 150 c.c. of 25 per cent. sodium hydroxide, shaking the mixture, filtering off the precipitate, and repeating the addition of acetone and bromine to the filtrate four times in succession, the weight of tetrabromide obtained being 19.3 grams. The product is recrystallised from methyl alcohol, from which it separates in small, colourless or slightly yellow plates, which, after washing with water and drying, may be kept for several months without decomposition if not exposed to direct sunlight.

P. H.

**Reciprocal Replacement of Metals in Aqueous Solutions.** GEORGE MCPHAIL SMITH (*J. Amer. Chem. Soc.*, 1905, 27, 540—551. Compare *Abstr.*, this vol., ii, 164).—The experiments described in this paper show that the following pairs of metals are reciprocally replaceable in aqueous solution, the first metal of each pair being more readily replaceable by the second than the second is by the first. K, Na; K, Ba; Na, Ba; Zn, Cu; Cd, Cu; Fe, Hg; Fe, Ag; Hg, Ag; Hg, Pt; Hg, Au; Ag, Au. The conditions necessary for the reverse replacements, that is, the replacement of the second metal by the first of each pair, are described. For details of the experiments, the original must be consulted.

E. G.

**Action of Potassammonium on Barium Bromide.** ALEXANDRE JOANNIS (*Compt. rend.*, 1905, 140, 1243—1245).—When dry barium bromide is treated with pure dry ammonia, the compound  $\text{BaBr}_2 \cdot 8\text{NH}_3$  is formed. Its dissociation tension is equal to 760 mm. at  $35.4^\circ$ . Potassium bromide dissolves readily in liquid ammonia, and on cooling the compound  $\text{KBr} \cdot 4\text{NH}_3$  separates in crystals which melt at about  $-45^\circ$ . The vapour pressure of the crystals near the melting point is less than the atmospheric pressure. When the compound  $\text{BaBr}_2 \cdot 8\text{NH}_3$  is brought into contact with potassammonium, a reaction takes place which extends over 2—3 days. Hydrogen is evolved and barium amide and potassium bromide are formed,  $\text{BaBr}_2 + 2\text{NH}_3\text{K} = \text{Ba}(\text{NH}_2)_2 + 2\text{KBr} + \text{H}_2$ . The potassium bromide can be removed from the reaction products by repeated washing with liquid ammonia.

H. M. D.

**Revision of the Atomic Weights of Sodium and Chlorine.** THEODORE W. RICHARDS and ROGER CLARK WELLS (*J. Amer. Chem. Soc.*, 1905, 27, 459—529).—Accurate determinations have been made of the values of the ratios  $\text{AgCl} : \text{NaCl}$ ,  $\text{Ag} : \text{NaCl}$ , and  $\text{Ag} : \text{AgCl}$ .

The sodium chloride employed was obtained from various sources and purified in several different ways, but the equivalent weight from all the samples was practically identical. It is evident from these experiments that pure sodium chloride can be easily prepared and that water can be expelled from the salt by fusion without loss of chlorine. Moreover, since it was found that the equivalent weight does not vary whether the salt is fused in a vacuum or in air, it is clear that the substance does not contain appreciable amounts of occluded oxygen or nitrogen.

The silver used in this investigation was precipitated by ammonium formate and ignited in a boat of pure lime. It was found that silver fused in hydrogen yielded exactly the same proportion of silver chloride as that which had been fused in a vacuum, a result which supports Stas' conclusion that silver does not dissolve more than 0.0004 per cent. of hydrogen. The purification of silver is best effected by fusion on pure lime in an atmosphere of pure hydrogen and subsequent fusion in a vacuum.

In precipitating silver chloride from aqueous solutions, it is necessary to use very dilute solutions, as otherwise the precipitate is liable to occlude traces of other substances which cannot always be removed. A study was made of the conditions under which such impurities are occluded and eliminated; it was found that in Stas' method of adding solid sodium chloride to a solution of a silver salt some salt is always occluded in the silver chloride. Attention is directed to various points which must be taken into consideration in accurate work of this kind.

The variable solubility of silver chloride has been investigated and the precautions to be observed in estimating traces of chlorine and silver by means of the nephelometer (Abstr., 1904, ii, 287) have been ascertained. Fused silver chloride appears to contain traces of dissolved air, but the amount is extremely small, since no appreciable loss in weight occurs on subsequent fusion in a vacuum.

The results of ten experiments for determining the value of the ratio  $\text{NaCl} : \text{AgCl}$  with nine samples of sodium chloride prepared in different ways gave an average of 40.780:100, whence the atomic weight of sodium is 23.017 ( $\text{Ag} = 107.930$ ;  $\text{Cl} = 35.455$ ).

In twelve other experiments made with seven different preparations of sodium chloride and three of silver, it was found that  $\text{NaCl} : \text{Ag} = 54.185 : 100$ , whence the atomic weight of sodium is 23.027.

In another series of ten experiments, it was found that the ratio  $\text{Ag} : \text{AgCl} = 100 : 132.867$ . Two different methods of synthesis of the silver chloride were used, and the silver employed was obtained from various sources, but the results were practically identical. From these results, it is found that if the atomic weight of silver is taken as 107.920, a value which is probably more accurate than 107.930, the atomic weight of sodium is 23.006 and that of chlorine 35.470; if the atomic weight of silver is taken as 107.930, that of sodium becomes 23.008 and that of chlorine 35.473.

These new values affect considerably the figures in the second decimal place of all the atomic weights depending on those of chlorine, sodium, or silver, and render necessary a recalculation of all the atomic weights.

The paper contains a very full discussion of the sources of error in Stas' experiments. E. G.

**Reactions with Sodium Thiosulphate.** FRANZ FAKTOR (*Chem. Centr.*, 1905, i, 1524; from *Pharm. Post.*, 38, 219. Compare Abstr., 1902, ii, 256).—When sodium thiosulphate is boiled with magnesium ribbon, magnesium hydroxide and hydrosulphide are formed. When iron powder (*ferrum limatum*), sheet silver, copper shavings, or lead foil is heated with sodium thiosulphate, the black metallic sulphides are formed, whilst bismuth yields the brown sulphide and cadmium forms a yellow solution. Rose's metal on warming with the thiosulphate forms black flakes of lead and bismuth sulphides; on boiling with sodium hydroxide, the solution becomes yellow and a sulphide is formed. Alkaline solutions of thallium salts give a white precipitate with sodium thiosulphate which dissolves on boiling, forming a brown solution; brownish-black thallous sulphide,  $Tl_2S$ , separates out on the addition of hydrochloric, sulphuric, or acetic acid. When hot solutions of sodium thiosulphate and thallium salts are mixed, the liquid becomes brown. Thallous chloride,  $TlCl$ , is readily soluble in a solution of sodium thiosulphate, thallous bromide less so, and the iodide is insoluble.

Thallous dichromate,  $Tl_2Cr_2O_7$ , is an orange-yellow precipitate, which is somewhat soluble in water and dissolves in a solution of sodium thiosulphate forming the yellow chromate,  $Tl_2CrO_4$ . When the solution of dichromate in sodium thiosulphate is warmed with ammonium chloride, chromium hydroxide,  $Cr_2(OH)_6$ , is precipitated. Mercurous chloride dissolves in sodium thiosulphate, and the solution forms a black precipitate on heating; when the solution is boiled with gold chloride, mercury and gold sulphide,  $Au_2S_3$ , separate and mercuric chloride may be estimated in the filtrate. When mercuric oxide is heated with sodium thiosulphate, the red sulphide is formed, and the red sulphide under similar conditions becomes of a more brilliant tint.

E. W. W.

**Electrolytic Deposition of Silver.** RALPH C. SNOWDON (*J. Physical Chem.*, 1905, 9, 392—398).—The experiments were performed chiefly with a view to ascertaining the possibility of obtaining a plating deposit of silver from the solution of the nitrate. It was found that a good, coherent, finely-crystalline deposit can be obtained by rapid rotation of the cathode and separation of the anodic and cathodic liquids, and the author considers that if means for a higher speed of rotation were available, burnished deposits would result. The addition of small quantities of glue to the solution had remarkable effects, smooth, bright purple or yellow deposits with no visible crystalline structure being obtained, which resemble some of Carey Lea's deposits from organic salts. L. M. J.

**Colloidal Silver.** ALEXANDER GUTBIER and GUSTAV HOFMEIER (*Zeit. anorg. Chem.*, 1905, 45, 77—80).—The authors describe colour phenomena seen on forming colloidal silver in presence of gum arabic, which bear on Blake's suggestion (Abstr., 1904, ii, 31) of the existence of three (or four) allotropic coloured forms of silver. Fifty c.c. of gum arabic solution (1 : 100) were mixed with (1) 100 c.c.



of silver nitrate solution (1 : 1000) and 50 c.c. of water; (2) 25 c.c. of silver nitrate and 125 c.c. of water; (3) 10 c.c. of silver nitrate and 140 c.c. of water; (4) 5 c.c. of silver nitrate and 145 c.c. of water; (5)  $1\frac{1}{2}$  c.c. of silver nitrate and 148.5 c.c. of water; the solutions (each 200 c.c.) thus prepared were reduced by hydrazine hydrate (1 : 2000) and the hydrosols of silver obtained were purified by dialysis. The colours of the hydrosols varied with the concentration, and were for the five cases dark olive-green, olive-green, brownish, grey, and greyish respectively by reflected light; brownish-red, red, dark violet, violet, faint violet respectively by transmitted light.

Hydrosols obtained by reduction of ammoniacal silver nitrate with phenylhydrazine hydrate are black by reflected light, green by transmitted light.

With hypophosphorous acid as reducing agent in presence of gum arabic, a light brown solution is obtained, which becomes dark brown and then deep red. If this liquid is now heated slowly to boiling, it becomes deep brown, then olive-green; the olive-green colour continues even after dialysis.

D. H. J.

**Action of Carbon Monoxide on Silver Oxide. Detection of Traces of the Gas in the Atmosphere.** HENRI DEJUST (*Compt. rend.* 1905, 140, 1250—1252. Compare Gautier, *Abstr.*, 1898, ii, 535).—When carbon monoxide acts on dry silver oxide at the ordinary temperature, a considerable amount of heat is developed and metallic silver is formed:  $\text{Ag}_2\text{O} + \text{CO} = \text{Ag}_2 + \text{CO}_2 + 61.2 \text{ Cal.}$  It is sometimes necessary to raise the temperature of the oxide to  $40\text{--}50^\circ$  before the reaction sets in. The gas also acts slowly on the oxide suspended in water; metallic silver is deposited and a yellowish-brown solution is formed which also deposits silver. The reaction takes place much more rapidly in ammoniacal solution; the colourless solution turns brown, then black, and deposits silver. A simple means of utilising this reaction for the approximate estimation of carbonic oxide in the air is described.

H. M. D.

**Metallic Calcium. II.** KURT ARNDT (*Ber.*, 1905, 38, 1972—1974. Compare *Abstr.*, 1903, ii, 76; this vol., ii, 87).—The author describes three alloys of aluminium and calcium, containing 23.4, 41.79—45.44, and 80.55—83.32 per cent. of calcium respectively. They had the sp. gr. 2.18, 2.26—2.38, and 1.74—1.81 respectively, and melted at  $765^\circ$  (corr.),  $1050^\circ$ , and  $600^\circ$  respectively. When the percentage of aluminium in the alloy is high, calcium may be separated from aluminium by distillation under diminished pressure.

Alloys of calcium and aluminium may be prepared by electrolysis fused calcium chloride with fused aluminium as the cathode.

A. McK.

**Calcium Sulphate in Ammonium Sulphate Solution.** EUGENE C. SULLIVAN (*J. Amer. Chem. Soc.*, 1905, 27, 529—539).—Determinations of the solubility of calcium sulphate in water and in solutions of ammonium sulphate at  $25^\circ$  have given the following results. The solubility in water is 0.2083 gram per 100 c.c. On the first addition of ammonium sulphate to the aqueous solution, a notable decrease in

the solubility of the calcium sulphate is observed. As the concentration of the ammonium sulphate increases, the fall becomes more gradual, and the solubility passes through a minimum equal to about two-thirds of its original value when the concentration is about 0.09 mol. per litre. From this point, the solubility gradually increases until the concentration of the ammonium sulphate is 0.6 mol. per litre, when the solubility of the calcium sulphate has the same value as in pure water. With 3 mols. of ammonium sulphate per litre, the solubility of calcium sulphate is twice as great as in water. The curve expressing the results is similar to that obtained by Seidell and Cameron (Abstr., 1902, ii, 207) for solutions of calcium sulphate and sodium sulphate.

The specific conductivity of concentrated ammonium sulphate solutions is decreased by saturation with calcium sulphate. On the assumption that ammonium sulphate is dissociated into  $2\text{NH}_4^+$  and  $\text{SO}_4^{--}$ , and calcium sulphate into  $\text{Ca}^{++}$  and  $\text{SO}_4^{--}$ , and that the conductivity is a measure of such dissociation, the solubility of calcium sulphate in dilute ammonium sulphate is greater than that required by the mass law.

The results are in accordance with the isohydric principle of Arrhenius (Abstr., 1899, ii, 201). The calculations show that the concentration of the non-dissociated calcium sulphate decreases as the amount of ammonium sulphate is increased. E. G.

**Calcium Carbonate. II. Precipitation.** WILHELM MEIGEN (*Chem. Centr.*, 1905, i, 1363—1364; from *Ber. naturfor. Ges. Freiburg i. Br.*, 15, 38—54, 55—74. Compare *ibid.*, 13, 40).—From the results of 36 experiments in which calcium carbonate was precipitated from the nitrate,  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ , in various ways by means of normal sodium carbonate, sodium hydrogen carbonate, ammonium carbonate, and potassium carbonate, the following conclusions have been drawn. Calcium carbonate always separates from a mixture of cold solutions of the nitrate and alkali carbonate in an amorphous state and may remain in this condition for several days. When the solutions are hot, the precipitate probably also separates in an amorphous form, but cannot be isolated in this condition owing to the rapidity with which it changes into the crystalline form. The amorphous carbonate may become crystalline in either the calcite or aragonite form. The aragonite form always separates from cold solutions as spherical or globular aggregations, and from hot solutions in needles; the latter is a much less stable form. Normal sodium carbonate precipitates calcium carbonate from cold concentrated solutions, principally in the form of globular aragonite. Dilute solutions do not so readily yield aragonite, and the change of this form to calcite takes place more rapidly in such solutions. In hot solutions, calcite is readily precipitated; when aragonite is formed, it separates in needles and is more stable when precipitated from dilute solutions. In cold solutions, sodium hydrogen carbonate yields principally calcite, and when the solutions are dilute no trace of aragonite is formed; from hot solutions, however, aragonite separates in the form of very stable needles. The precipitate obtained by adding ammonium carbonate to cold concentrated solutions

consists of aragonite globules, but in dilute solutions aragonite is not formed; both kinds separate together from hot solutions. The addition of ammonia aids the formation of aragonite. Sodium carbonate and potassium carbonate throw down amorphous calcium carbonate from cold concentrated solutions. On the whole, calcium nitrate behaves like calcium chloride, but in the former case, when aragonite is formed, it is more stable than in the latter, since the presence of excess of nitrate has less effect on the precipitation. The calcite form is precipitated from solutions of calcium sulphate by all carbonates except normal sodium carbonate, which gives aragonite. From zinc solutions, aragonite effects more complete precipitation than calcite, but in the case of copper the inverse is true. Copper is completely precipitated by calcite from a solution of the nitrate in 8 hours, but aragonite requires a much longer time. Lead is also precipitated by both forms, but more quickly by aragonite. The precipitation of silver from concentrated solutions is similar to that of lead or copper.

III. *Behaviour of Calcium Carbonate towards Cobalt Salts* (compare *Centr. Min.*, 1901, 577).—By the action of finely divided aragonite on concentrated solutions of cobalt nitrate, a lilac-coloured precipitate,  $2\text{CoCO}_3, 3\text{Co}(\text{OH})_2, \text{H}_2\text{O}$ , is formed; it may be heated at  $80\text{--}85^\circ$  without decomposing, but loses  $1\text{H}_2\text{O}$  at  $95^\circ$ . The blue precipitate formed by calcite under similar conditions has probably the composition  $\text{CoCO}_3, 3\text{Co}(\text{OH})_2$ . The lilac-coloured precipitate, prepared by adding aragonite to more dilute solutions of the nitrate, has the composition,  $\text{CoCO}_3, 2\text{Co}(\text{OH})_2$ ; finely divided calcite gives a precipitate of the same composition and colour under similar conditions, but in other cases the precipitate is probably a mixture of the blue basic carbonate with more or less hydroxide. The precipitates formed by aragonite resist the action of oxidising agents much more than those formed by calcite. Solutions of cobalt chloride behave, on the whole, in a similar way, but the precipitates always contain chlorine, and the longer the duration of the action the greater the quantity of chlorine in the precipitate; a basic cobalt chloride,  $\text{CoCl}_2, \text{Co}(\text{OH})_2, 5\text{H}_2\text{O}$ , is probably formed. By the action of calcite and aragonite on solutions of cobalt sulphate, blue- and lilac-coloured precipitates are formed respectively, but the latter on boiling also becomes blue; both precipitates contain considerable quantities of sulphuric acid.

E. W. W.

**Strontium-ammonium.** ROEDERER (*Compt. rend.*, 1905, 140, 1252—1253).—By the action of pure dry ammonia on strontium at  $-60^\circ$ , reddish-brown crystals of strontium-ammonium are formed which dissolve in excess of ammonia to a deep blue solution.

The dissociation tension of the crystals is about 10 mm. at  $-40^\circ$  and 760 mm. at  $+46^\circ$ . Analysis of the crystals which remain when the ammonia solution is evaporated at different temperatures gave  $\text{Sr}, 6.38\text{NH}_3$  at  $-60^\circ$ ,  $\text{Sr}, 6.15\text{NH}_3$  at  $-23^\circ$ , and  $\text{Sr}, 6.01\text{NH}_3$  at  $0^\circ$ . The probable formula is  $\text{Sr}, 6\text{NH}_3$ , analogous to that of the barium compound.

H. M. D.

**Some Reactions with Magnesium.** FRANZ FAKTOR (*Chem. Centr.*, 1905, i, 1305; from *Pharm. Post.*, 38, 153).—By the action of



magnesium ribbon on sodium thiosulphate, magnesium hydroxide and hydrogen are formed, whilst magnesium powder under similar conditions becomes greyish-black, and on the addition of hydrochloric acid gives off hydrogen sulphide. With a solution of iodine, magnesium iodide is formed and the liquid becomes green. Potassium dichromate and potassium permanganate are reduced by magnesium, the former to chromate. By the action of the metal on salts of antimony (antimony trichloride or potassium antimony tartrate), hydrogen and antimony hydride are liberated, whilst antimony separates in the form of black flakes. Bismuth is deposited as a black powder from solutions of the chloride or nitrate, and solutions of gold and platinum salts are reduced to the metal with liberation of hydrogen. Salts of silver are also reduced, but hydrogen is not formed. By the action of magnesium on zinc, cadmium, stannous, or bismuth salts, the metallic hydroxide and hydrogen are formed. Grey metallic thallium separates from thallium salts, and hydrogen is liberated, whilst thallium alum first yields the metal and then the hydroxide. Yellow uranyl oxide and blue molybdenum oxide are formed by the action of magnesium on uranyl salts and ammonium molybdate respectively.

In order to test for aldehydes, a solution of magenta is heated with a few pieces of magnesium ribbon until the colour disappears. An intense violet-red coloration is formed on the addition of an aldehyde. When magnesium powder is used, the solution should be filtered before adding the aldehyde. A solution of quinone becomes brown when warmed with magnesium; potassium ferricyanide is converted into ferrocyanide, and a solution of indigo is rapidly decolorised.

E. W. W.

#### Equilibrium between Magnesium and Sodium Sulphates.

R. BECKETT DENISON (*Trans. Faraday Soc.*, 1905, i, 136—139).—At 25°, only one double salt of these components has been obtained, namely, blödite,  $\text{Na}_3\text{Mg}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ , whilst at somewhat higher temperatures two others appear: loewite,  $\text{Na}_4\text{Mg}_2(\text{SO}_4)_4 \cdot 5\text{H}_2\text{O}$ , and vanthoffite,  $\text{Na}_6\text{Mg}(\text{SO}_4)_4$ . The author's experiments were made with a view to ascertaining whether a double salt analogous to langbeinite,  $\text{K}_2\text{Mg}_2(\text{SO}_4)_3$ , was not capable of existence. Dilatometric experiments as well as tensimetric measurements with a Bremer-Frowein tensimeter indicated that a sodium-langbeinite cannot exist in contact with solution, at least up to 90°, and that at about 59° blödite in presence of  $\text{MgSO}_4$  changes into loewite.

L. M. J.

**New Oxyhaloids of Mercury.** THEOPHILE FISCHER and H. VON WARTENBERG (*Chem. Zeit.*, 1905, 29, 308).—Mercurous oxychloride,  $\text{HgCl} \cdot \text{HgO}$ , forms small, red prisms, mercurous oxybromide,  $\text{HgBr} \cdot \text{HgO}$ , dark red, slender, rhombic plates (crystal angles 89° and 91°), and mercurous oxyiodide,  $\text{HgI} \cdot 3\text{HgO}$ , brownish-red, rhombic plates. The compounds were obtained by heating the corresponding mercurous haloids with mercuric oxide and water in sealed tubes for 48—80 hours at 160—180°.

P. H.

**Action of Sodium Nitrate on Native Sulphides.** JOH. MATUSCHEK (*Chem. Zeit.*, 1905, 29, 510—511).—The author states that under certain conditions galena yields a considerable quantity of metallic lead when heated in a crucible with sodium nitrate. A portion of the metal may be similarly obtained from black antimony, copper glance, and silver glance.

Lead introduced into melted nitre to which some potassium chlorate has been added yields red lead in a somewhat granular form.

L. DE K.

**Existence of a Definite Lead Potassium Sulphate.** FRANK G. BELTON (*Chem. News*, 1905, 91, 191).—When a 10 per cent. solution of lead nitrate is digested at 75° with a saturated solution of potassium sulphate, white, amorphous lead potassium sulphate,  $\text{PbK}_2(\text{SO}_4)_2$ , is obtained. It is decomposed readily by water.

When potassium salts are present in excess, lead salts should be precipitated in the presence of excess of sulphuric acid and at the boiling point.

D. A. L.

**Salts of Cerium.** HERMANN WOLFF (*Zeit. anorg. Chem.*, 1905, 45, 89—115).—In the following,  $P$  denotes the percentage of anhydrous salt dissolved in the saturated aqueous solution.

*Ceric ammonium nitrate*,  $\text{Ce}(\text{NO}_3)_4 \cdot 2\text{NH}_4\text{NO}_3$ . The values of  $P$  found were: at 25°, 58.49; at 35.2°, 61.79; at 45.3°, 64.51; at 64.5°, 66.84; 85.6°, 69.4; at 122°, 88.03. For the interval from 25° to 85°, the interpolation formula,  $P = 52.07 + 0.314t - 0.0013t^2$ , expresses the results. Above 60°, there is a partial reduction of the ceric salt in solution to cerous salt; towards the boiling point of the saturated solution, say 122°, the proportion of cerous salt present is considerable (9.8 per cent. in one case after 3 hours' boiling).

*Cerous ammonium nitrate*,  $\text{Ce}(\text{NO}_3)_3 \cdot 2\text{NH}_4\text{NO}_3 \cdot 4\text{H}_2\text{O}$ . This salt is stable in aqueous solutions at temperatures from 9—55°. The experimental values of  $P$  were: at 8.75°, 70.2; at 25.0°, 74.8; at 45°, 80.4; at 60°, 87.2; at 65.06°, 89.1. The solubilities from 25—65° are expressed by the formula  $P = 68.7 + 0.172t + 0.002t^2$ . Solubilities at higher temperatures cannot be determined, as the salt melts in its water of crystallisation at 74°.

*Cerous ammonium sulphate*,  $\text{Ce}_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4$  and  $\text{Ce}_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$ .

The experimental values of  $P$  were: at 22.3°, 5.061; at 22.35°, 5.058; at 35.1°, 4.928; at 45.2°, 4.755; at 45.0°, 2.907; at 55.2°, 2.140; at 55.3°, 2.191; at 75.4°, 1.46; at 85.2°, 1.17. A graphic representation of the results shows a curve with two branches corresponding with the hydrated and anhydrous salts; at 45°, it is possible to obtain two saturation concentrations, corresponding with the hydrated and non-hydrated salts. In the solid state, the hydrated salt loses  $6\text{H}_2\text{O}$  at 100°, the remaining  $2\text{H}_2\text{O}$  not until 150°. By the action of cerium carbonate on propionic, butyric, and isobutyric acids, cerium salts similar to the known formate and acetate have been prepared.

*Cerous formate*,  $\text{Ce}(\text{CHO}_2)_3$ . Values of  $P$  found were: at 13°,

0.398; at  $75^{\circ}$ , 0.374; the solubility is therefore intermediate between the solubilities of lanthanum and didymium formates.

*Cerous acetate*,  $\text{Ce}(\text{C}_2\text{H}_3\text{O}_2)_3, 1\frac{1}{2}\text{H}_2\text{O}$ , is also less soluble in hot water than in cold. Solubilities found: *P* at  $15^{\circ}$ , 19.61; at  $76.2^{\circ}$ , 12.97.

*Cerous propionate*,  $\text{Ce}(\text{C}_3\text{H}_5\text{O}_2)_3, \text{H}_2\text{O}$  (from warm solutions),  $\text{Ce}(\text{C}_3\text{H}_5\text{O}_2)_3, 3\text{H}_2\text{O}$  (from cold solutions). *P* at  $15^{\circ}$ , 18.99; at  $76.4^{\circ}$ , 15.93.

*Cerous butyrate*,  $\text{Ce}(\text{C}_4\text{H}_7\text{O}_2)_3$ , crystallises in the anhydrous condition from hot alcohol (in which it is sparingly soluble) and with  $3\text{H}_2\text{O}$  from cold aqueous solutions. *P* at  $11^{\circ}$ , 3.544; at  $15^{\circ}$ , 3.406; at  $76.9^{\circ}$ , 1.984.

*Cerous isobutyrate*,  $\text{Ce}(\text{C}_4\text{H}_7\text{O}_2)_3, 3\text{H}_2\text{O}$ . Values of *P*: at  $20.4^{\circ}$ , 6.603; at  $75.8^{\circ}$ , 3.39.

*Cerous chloroacetate*,  $\text{Ce}(\text{C}_2\text{H}_2\text{ClO}_2)_3, 1\frac{1}{2}\text{H}_2\text{O}$ , is obtained by dissolving cerium carbonate in chloroacetic acid and evaporating; it forms long needles.

*Cerous trichloroacetate*,  $\text{Ce}(\text{C}_2\text{Cl}_3\text{O}_2)_3, 3\text{H}_2\text{O}$ , is obtained by dissolving cerium in the acid and evaporating in a vacuum; it forms long needles. If an aqueous solution of the salt is boiled, the whole of the cerium separates as carbonate. The trichloroacetate is not oxidised by hydrogen dioxide, and thus differs from the cerium salts of the other organic acids mentioned previously.

D. H. J.

**New Spectrum of Gadolinium.** GEORGES URBAIN (*Compt. rend.*, 1905, 140, 1233—1234).—New lines in the ultraviolet absorption spectrum of gadolinium are recorded. The same results were obtained for gadolinium extracted from monazite, xenotime, and pitchblende. The metal showed the phosphorescence spectrum which has been attributed by Crookes to victorium. The author does not consider that this element and gadolinium have been definitely shown to be distinct from one another.

H. M. D.

**Purification of Praseodymium.** CHARLES BASKERVILLE (*Zeit. anorg. Chem.*, 1905, 45, 86).—In reply to Meyer (Abstr., 1904, ii, 734), the author insists on the efficiency of Baskerville and Turrentine's method of obtaining pure praseodymium compounds (Abstr., 1904, ii, 261).

D. H. J.

**Properties of some Anhydrous Chlorides of Rare Metals.** CAMILLE MATIGNON (*Compt. rend.*, 1905, 140, 1339—1341. Compare Abstr., 1904, ii, 340, 341; this vol., ii, 391, and Muthmann and Stützel, Abstr., 1900, ii, 142).—The liquids produced by melting the chlorides of lanthanum, praseodymium, neodymium, or samarium solidify to masses of deliquescent needles closely resembling in form the crystals of bacillary aragonite. Lanthanum chloride is colourless at all temperatures, has a sp. gr. 3.947 at  $18^{\circ}/4^{\circ}$ , and melts at  $907^{\circ}$ . On solution in water, it develops 31.3 Cal. at  $17^{\circ}$ , and the heat of formation from the oxide and hydrogen chloride is 80.3 Cal. Praseodymium chloride has a sp. gr. 4.017 at  $18^{\circ}/4^{\circ}$  and melts at  $818^{\circ}$ . The heat of formation from the oxide and hydrogen chloride is 73.9 Cal. (compare Abstr., 1902, ii, 263). Neodymium chloride is pink with a violet



tinge, and becomes green at its melting point; it has a sp. gr. 4.195 at  $18^{\circ}/4^{\circ}$ , melts at  $785^{\circ}$ , and on solution in water develops 35.4 Cal. at  $17^{\circ}$ . The heat of formation from the oxide and hydrogen chloride is 71.6 Cal. (compare Abstr., 1901, ii, 602). Samarium chloride is straw-yellow, and the tint deepens with increase of temperature. It has a sp. gr. 4.465 at  $18^{\circ}/4^{\circ}$ , melts at  $686^{\circ}$ , and on solution in water develops 37.4 Cal. at  $17^{\circ}$ . The heat of formation is 64.2 Cal. (compare Abstr., 1902, ii, 505).

T. A. H.

**Transformation of Oxides and Oxygenated Metallic Salts into Anhydrous Chlorides.** Application to Analysis. CAMILLE MATIGNON and F. BOURION (*Ann. Chim. Phys.*, 1905, [viii], 4, 127—136).—A résumé of work already published (Abstr., 1904, ii, 340, 341). Aluminium chloride was prepared by the general method (*loc. cit.*) from alumina, and samarium chloride from samarium sulphate.

T. A. H.

**Colloidal Ferric Chlorides.** G. MALFITANO (*Compt. rend.*, 1905, 140, 1245—1247).—Solutions containing 5 grams of ferric chloride per litre were maintained at  $40^{\circ}$  and the hydrolysis followed by measurement of the electrical conductivity. This having become nearly constant, the solutions were filtered through a collodion membrane and the precipitated colloid analysed. Similar experiments were made with solutions heated at  $100$ — $130^{\circ}$ . The percentage of chlorine in the precipitated residues is very variable. The formulæ  $\text{Fe}_2\text{Cl}_6 \cdot n\text{Fe}_2(\text{OH})_6$  ( $n = 1.5$ — $7.2$ ) and  $\text{HCl}_n\text{Fe}_2(\text{OH})_6$  ( $n = 1.1$ — $6.7$ ) are employed to express the composition of the precipitates from the cold and the hot solutions.

H. M. D.

**Solubility of Ferric Oxide in Hydrofluoric Acid.** ERNST DEUSSEN (*Zeit. angew. Chem.*, 1905, 18, 813—815).—The author has determined the solubility of ferric oxide in hydrofluoric acid, hydrochloric acid, and oxalic acid respectively at  $25^{\circ}$ . Hydrofluoric acid dissolves rust more quickly than does hydrochloric acid, and may with advantage be used for the removal of rust from laboratory apparatus.

A. McK.

**Electrolytic Precipitation of Nickel on Nickel.** RALPH C. SNOWDON (*J. Physical Chem.*, 1905, 9, 399—401).—When nickeled work has to be replated, it must be entirely freed from the previous deposit of nickel, as otherwise the deposit does not adhere, but readily peels off. The author's experiments show that if the nickel be made the cathode in an acid solution and a fairly large current be passed for a short time, it will, if quickly washed and transferred to the plating solution, take a smooth, adherent deposit capable of burnishing. The author considers this behaviour to be due to the presence in the nickel of a thin film of oxide which cannot be removed except by vigorous reduction.

L. M. J.

**Nickelic Salts.** CARL TUBANDT (*Zeit. anorg. Chem.*, 1905, 45, 73—76).—Up to the present, the sesquioxide is the only tervalent compound of nickel known.

By the electrolysis of a strong solution of either (1) potassium hydrogen carbonate, in presence of a nickel anode and with employment of a current of 1 to 2 amperes per sq. dem., or (2) of nickel carbonate in strong potassium hydrogen carbonate solution in presence of platinum electrodes and with employment of a current of 0.1 to 1 ampere per sq. dem., an unstable red solution of a nickelic salt is obtained, which becomes quite colourless an hour after the interruption of the current, and (from the stronger solutions) deposits black nickel oxide. The solution may be filtered through glass wool, but is partly decomposed by paper filters; the colour is discharged by hydrogen peroxide, any percarbonate or persulphate, chlorine or bromine. The red liquid liberates iodine from potassium iodide, and thus a quantitative estimation of the oxygen combined with one atom of nickel may be made, with the result that the nickel is found to be in the trivalent form. The new nickelic salt has not been isolated.

D. H. J.

**Electrolytic Chromium.** HECTOR R. CARVETH and B. E. CURRY (*J. Physical Chem.*, 1905, 9, 353—380. See this vol., ii, 394).—The authors first review previous work on the electrolysis of chromic acid, and find that amongst other points this still leaves doubtful the question whether or not metallic chromium may be deposited in the electrolysis of chromic acid solution, and if so what are the conditions. Their own results showed that with an impure acid, chromium was deposited, this occurring instantaneously at 18° for a current density of about 80 amperes per sq. decimetre. With pure acid, the deposition was also obtained, but not so readily as with the impure acid; the decomposition voltage was found to be 2.31 volts. The effect of sulphuric acid was marked in increasing the deposition of metal, and in some cases more than one-half the total chromium was removed as metal. In all cases, the solution was coloured brown, and chromic salts were produced; a brown precipitate was also formed at the cathode, this being probably  $\text{CrCrO}_4$ . The authors consider it probable that hexavalent chromium cations are present in the solutions of chromic acid, and that the increase of deposition caused by sulphuric acid is due to the increase of concentration of these cations, owing to a reaction of  $\text{CrO}_3$  with the acid. It was found that the electrolytically deposited chromium can occlude about 250 times its volume of hydrogen, 24.6 c.c. being obtained from 0.698 gram of metal.

L. M. J.

**A Variable Velocity Reaction of Green Chromic Sulphate.** ALBERT COLSON (*Compt. rend.*, 1905, 140, 1451—1454. Compare this vol., ii, 94).—Further evidence in favour of the constitutional formula  $\text{SO}_4 \begin{smallmatrix} \text{Cr}:\text{SO}_4 \\ | \\ \text{Cr}:\text{SO}_4 \end{smallmatrix}$ , suggested for the green chromic sulphate, is afforded by

the behaviour of the salt towards barium chloride; in boiling solutions, the decomposition of the mixture  $\text{Cr}_2(\text{SO}_4)_3 + 3\text{BaCl}_2$  is complete in a few minutes, but at the ordinary temperature there is a discontinuity in the reaction; the addition of 1 mol.  $\text{BaCl}_2$  to 1 mol.  $\text{Cr}_2(\text{SO}_4)_3$  causes an immediate precipitation of  $\text{BaSO}_4$  with a heat development of 7.15 Cal., whilst the addition of 2 to 3 mols.  $\text{BaCl}_2$  to 1 mol.  $\text{Cr}_2(\text{SO}_4)_3$  is

followed by an immediate precipitate, but the liquid remains turbid for an indefinite period, and the heat developed does not exceed 7.6 Cal.

M. A. W.

**Higher Oxidation Products of Chromium.** E. H. RIESENFELD, H. E. WOHLERS, and W. A. KUTSCH (*Ber.*, 1905, **38**, 1885—1898).—By the direct oxidation of chromate solutions with hydrogen peroxide in alkaline solution below 0°, salts of the hypothetical acid  $H_2CrO_8$  have been obtained. The *ammonium* salt,  $(NH_4)_3CrO_8$ , crystallises in small, reddish-brown, doubly refractive octahedra, with a red reflex; the *sodium* salt forms reddish-yellow, doubly refractive, glistening plates, and decomposes with evolution of oxygen to an amorphous, bright yellow powder; the *potassium* salt is somewhat darker in colour than the ammonium, but in other respects resembles it. In acid solution, blue salts such as  $KH_2CrO_7$  and  $(NH_4)H_2CrO_7$  are formed on oxidation with hydrogen peroxide. The red salts decompose in neutral or alkaline solution into chromate, whilst in acid solution perchromic acid is formed, and is instantly reduced to a chromic salt. For the analysis of these salts, a special method based on the gasometric estimation of the oxygen evolved is described in detail. The red salts described by Hofmann and Hiendlmaier (*Abstr.*, 1904, ii, 410) have also been prepared and carefully analysed, and proved to have the formula  $(NH_4)_3CrO_8$ , and not  $(NH_4)_2CrO_6$ , as assumed by these authors.

E. F. A.

**Metastannic and Metazirconic Acids.** JAKOB M. VAN BEMMELEN (*Zeit. anorg. Chem.*, 1905, **45**, 83—85).—Ruer (this vol., ii, 256) gave to metazirconic acid dried at 100° the formula  $3ZrO_2 \cdot 2H_2O$ ; the author suggests that the proportion of water found by Ruer in his experiments was accidental, and emphasises in this connection the analogy between metastannic and metazirconic acids.

D. H. J.

**Separation of Thorium and the Cerite Earths by Normal Sodium Sulphite.** ALEXANDER BATĚK (*Zeit. anorg. Chem.*, 1905, **45**, 87—88).—The method of separation used by Grossmann (this vol., ii, 326) had been already described by the author (*Bohemian Acad. Sci. Prag*, 1902). For the separation, the basic sulphates are suspended in water (Bunsen-Brauner method) and treated for 2 hours with a rapid stream of sulphur dioxide; from the filtrate, basic sulphate is again prepared and treated with sulphur dioxide; after four operations, a sulphate is obtained practically free from didymium. By continued fractional treatment with sulphur dioxide, the basic neodymium and praseodymium sulphates may be separated from the less basic cerium sulphate, as the former are more easily converted by sulphur dioxide into soluble normal sulphates.

D. H. J.

**Alloys of Copper and Bismuth.** ARTHUR H. HIRNS (*Trans. Faraday Soc.*, 1905, **1**, 179—186).—An account of the appearance and micro-structure of alloys of copper and bismuth is given, and the freezing point curve is described. The latter consists of four branches; from the freezing point of bismuth, the curve falls to a freezing point 245° at 97 per cent. bismuth; it then rises rapidly, reaching 600° at 95 per



cent., after which it rises more slowly, so that with from 70 to 57 per cent. of bismuth it is almost horizontal. At 57 per cent. a break occurs and the curve rises to a maximum at  $1039^{\circ}$  for 95 per cent. copper, whence it falls to the eutectic point for pure copper in contact with a solution of bismuth in copper. A number of reproductions of photographs of polished and etched surfaces of the alloys are given in the paper.

L. M. J.

**Red Colloidal Solution of Gold obtained by means of Carbon Monoxide.** JULIUS DONAU (*Monatsh.*, 1905, 26, 525—530. Compare Zsigmondy, *Abstr.*, 1898, ii, 522; 1900, ii, 397; 1902, ii, 188).—Bright red to purple liquid hydrosols of gold are obtained by passing a current of carbon monoxide or carbon monoxide, diluted with carbon dioxide, through solutions of auric chloride in conductivity water containing 0.002—0.05 per cent. of gold. If ordinary distilled water or tap-water is used, or if the solution is dialysed through a porous cell, the presence of a protecting agent such as gelatin or gum arabic is necessary to the stability of the hydrosol. A liquid hydrosol containing 0.005 per cent. of gold can be concentrated to 1/30 of its volume by boiling in a vacuum before precipitation takes place. The liquid hydrosol is decolorised when shaken with animal charcoal, barium sulphate, powdered porcelain, amorphous silica, fibres of filter paper, and electrolytes. These precipitations are diminished or prevented by the presence of gum arabic or gelatin. The conversion of auric chloride into colloidal gold by carbon monoxide is complete, as a liquid hydrosol, after precipitation with hydrochloric acid and filtration, yields a filtrate containing no gold. On electrolysis of the colloidal gold solution, phenomena are observed resembling those described by Blake (*Abstr.*, 1904, ii, 130).

The formation of the red liquid hydrosol of gold is observed on shaking a dilute solution of auric chloride with a litre of air containing 1 c.c. of carbon monoxide.

G. Y.

**Gold-lead Alloys.** RUDOLF VOGEL (*Zeit. anorg. Chem.*, 1905, 45, 11—23).—With the aid of cooling curves derived experimentally, the author has drawn up a complete equilibrium diagram for gold-lead alloys. In this diagram, the freezing point curve consists of four branches showing three eutectic points at  $215^{\circ}$ ,  $254^{\circ}$ , and  $418^{\circ}$  respectively. A consideration of the time required for eutectic crystallisation shows, according to Tammann's method (*Abstr.*, 1904, 113), that there are two definite compounds of gold and lead, namely,  $\text{AuPb}_2$  and  $\text{Au}_2\text{Pb}$ ; the occurrence of these compounds was confirmed by a microscopic examination of the alloys. At  $211^{\circ}$ , there is a polymorphous transformation of the alloy  $\text{AuPb}_2$ . This alloy forms brittle, long, white, needle-shaped crystals with rounded contours, and is easily distinguished in appearance from the large, well-formed crystals of the alloy  $\text{Au}_2\text{Pb}$ ; the latter is even more brittle than  $\text{AuPb}_2$ .

D. H. J.

**Gold-thallium Alloys.** MAX LEVIN (*Zeit. anorg. Chem.*, 1905, 45, 31—38).—Gold and thallium alloys have been studied by the

thermal methods of Tammann with a view to determine the chemical behaviour of the two metals. Cooling curves were made, and an equilibrium diagram constructed; the freezing points of both gold and thallium are lowered by addition of the other metal; the two branches of the freezing point curve intersect at a eutectic point corresponding with a temperature of  $131^{\circ}$  and with 27 per cent. of gold; there is no evidence of the existence of a definite compound of gold and thallium; this was confirmed by a microscopic examination of the alloys. On the cooling curve of pure thallium, a transformation-point was observed at  $225^{\circ}$ . From experiments on the velocity of efflux of thallium, Werigin, Lewkoëff, and Tammann (*Ann. Physik.*, 1903, [iv], 10, 647) drew the conclusion that there is a transformation from one crystalline form to another at  $180^{\circ}$ , hence the possibility of three crystalline modifications of thallium.

D. H. J.

**Halogen Compounds of Ruthenium.** ALEXANDER GUTBIER and C. TRENKNER (*Zeit. anorg. Chem.*, 1905, 45, 166—184).—To obtain the pure metal, the powdered material is heated at a red-heat in oxygen to remove osmium, and the residue (1 part), after reduction with hydrogen, is fused for half an hour with its own weight of potassium nitrate and 8.3 parts of potassium hydroxide; a rapid stream of chlorine is led (at first in the cold, later at  $80$ — $90^{\circ}$ ) through an aqueous solution of the product of fusion; the ruthenium tetroxide thus formed is condensed by a freezing mixture of ice and salt and reduced with alcohol; the metal is finally heated in hydrogen.

All attempts to prepare the ruthenious chloride,  $\text{RuCl}_2$ , or the ruthenium tetrachloride,  $\text{RuCl}_4$ , described by Claus were unsuccessful, nor could a ruthenious bromide be obtained. *Ruthenium sesquichloride*,  $\text{Ru}_2\text{Cl}_6$ , is obtained either by Claus' method or by evaporating the tetroxide with strong hydrochloric acid; the aqueous solution of the chloride decomposes easily on heating, even at  $50^{\circ}$ , into a hydrated oxide and hydrogen chloride. The double salts,  $\text{Ru}_2\text{Cl}_6 \cdot 4\text{RbCl}$  (dark brown crystals) and  $\text{Ru}_2\text{Cl}_6 \cdot 4\text{CsCl}$  (reddish-brown crystals), were prepared. *Ruthenium sesquibromide*,  $\text{Ru}_2\text{Br}_6$ , is best obtained in a similar way to the chloride; it forms dark scales. The following double salts were prepared:  $\text{Ru}_2\text{Br}_6 \cdot 4\text{KBr}$ ,  $\text{Ru}_2\text{Br}_6 \cdot 4\text{NH}_4\text{Br}$ ,  $\text{Ru}_2\text{Br}_6 \cdot 4\text{RbBr}$ ,  $\text{Ru}_2\text{Br}_6 \cdot 4\text{CsBr}$ .

*Ruthenium sesqui-iodide*,  $\text{Ru}_2\text{I}_6$ , is obtained as an amorphous, dark-coloured precipitate by heating a solution of ruthenium chloride with potassium iodide solution. The *ammonia compounds*,  $\text{Ru}_2\text{Br}_6 \cdot 7\text{NH}_3$  and  $\text{Ru}_2\text{I}_6 \cdot 7\text{NH}_3$ , corresponding with Joly's compound,  $\text{Ru}_2\text{Cl}_6 \cdot 7\text{NH}_3$ , are obtained by the action of dry ammonia on the haloid salts; they are insoluble in alcohol.

D. H. J.

## Mineralogical Chemistry.

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[Analysis of Dognácskaite.] ANTON OTTO (*Tsch. Min. Mitth.*, 1905, 24, 117—118).—The original analysis, by Maderspach (1884), of the incompletely described mineral dognácskaite is quoted below (I): a new analysis gave the results under II.

	S.	Bi.	Cu.	Fe <sub>2</sub> O <sub>3</sub> .
I.	15.75	71.79	12.23	—
II.	18.9	42.2	36.1	1.4

The new results agree with the wittichenite formula  $\text{Bi}_2\text{S}_3, 3\text{Cu}_2\text{S}$ . Dognácskaite is thus possibly identical with wittichenite, although the former has a distinct cleavage, whilst the latter has none.

L. J. S.

**Basic Magnesium Carbonates from the Volcanic Eruption at Santorin in 1866.** ALFRED LACROIX (*Compt. rend.*, 1905, 140, 1308—1311).—The crusts found on the fumaroles in the lava at Giorgios after the volcanic eruption at Santorin in 1866 were examined by Fouqué and found to consist of sodium chloride with small quantities of sodium sulphate and carbonate and magnesium chloride and carbonate. The author finds that these crusts contain the basic magnesium carbonate,  $4\text{MgCO}_3, \text{Mg}(\text{OH})_2, 4\text{H}_2\text{O}$ , both in the amorphous condition and in the form of birefringent spherulites, which Fritzsche observed in the artificial carbonate of this composition (*Ann. Phys. Chem.*, 1836, 37, 304). This mineral, which it is proposed to name *giorgiosite*, is regarded as a secondary product formed by the interaction of sodium carbonate with the magnesium chloride associated with the sodium chloride in the crusts. The mineralogical characters of giorgiosite are described briefly in the original.

T. A. H.

**Oceanic Salt Deposits. XLII. Formation of Glauberite.** JACOBUS H. VAN'T HOFF (*Sitzungsber. K. Akad. Wiss. Berlin*, 1905, 478—483).—It was sought to determine accurately the temperature of formation of glauberite and to ascertain whether a sodium salt analogous to syngenite is capable of existence. The following transition temperatures were observed in solutions of calcium and sodium sulphates: (1) dehydration of the decahydrated sodium sulphate at  $32.4^\circ$ ; (2) formation of sodium syngenite at  $30.2^\circ$ ; (3) formation of glauberite at  $29^\circ$ . These temperatures would be lowered by the presence of other salts and the values obtained for the three changes are respectively, in the presence of sodium chloride,  $17.9^\circ$ ,  $15.8^\circ$ , ( $14.8^\circ$ ); in presence of sodium chloride and glaserite or syngenite,  $16.3^\circ$ , ( $14.2^\circ$ ), ( $13^\circ$ ); in presence of sodium chloride and blödite,  $15.3^\circ$ , ( $13.2^\circ$ ), ( $12^\circ$ ); in the presence of sodium chloride, blödite, and glaserite or syngenite,  $13.7^\circ$ , ( $11.6^\circ$ ), ( $10.4^\circ$ ). The values in brackets are calculated probable values.

L. M. J.



**Zeophyllite from Radzein, Bohemia.** F. CORNU (*Tsch. Min. Mitth.*, 1905, 24, 127—134).—The recently described mineral zeophyllite (Abstr., 1904, ii, 349) is recorded from a new locality, namely, Radzein, situated between Aussig and Teplitz in Bohemia. It occurs here in an exceptionally fresh leucite-tephrite, associated with apophyllite, calcite, and hyalite, and forms hemispherical aggregates of radially arranged plates with perfect basal cleavage. In its characters, the mineral agrees with the zeophyllite from the original locality (Gross-Priesen); sp. gr. 2.748. L. J. S.

## Physiological Chemistry.

**Physicochemical Study of Hæmolysis.** Mlle. P. CERNOVODEANU and VICTOR HENRI (*Compt. rend.*, 1905, 140, 1394—1396).—It is found that the rate of hæmolysis of red blood corpuscles in presence of hæmolytic serum varies with the origin of the corpuscles and of the serum. Experiments have been made with corpuscles from the horse, the dog, and the fowl, and with serum extracts from the same animals. The velocity is conditioned by the rate at which the active constituent of the serum is absorbed by the corpuscles, and any change which influences this rate of absorption brings about an alteration in the velocity of hæmolysis. When two different kinds of corpuscles are simultaneously subjected to the action of an active serum, the hæmolysis which takes place in a given time is less than the sum of the effects produced when each kind of corpuscle is separately acted on by the serum under otherwise similar conditions. If two active sera of different origin act simultaneously on one species of corpuscle, the observed effect is much greater than the sum of the effects produced when the two active sera act alone under otherwise similar conditions. H. M. D.

**Hæmolytic Action of Photodynamic Substances.** G. SACHAROW and HANS SACHS (*Chem. Centr.*, 1905, i, 1420—1421; from *Münch. med. Woch.*, 52, 297—299). **Action of Light on Mixtures of Blood and Eosin. Action of Fluorescent Substances (Eosin) on Normal Serum and Red Blood Corpuscles.** HERMANN PFEIFFER (*Chem. Centr.*, 1905, i, 1421; from *Wien. klin. Woch.*, 18, 221—222, 328—330).—In agreement with Sacharow and H. Sachs, who have worked at the hæmolytic action of various photodynamic materials, but especially with eosin, Pfeiffer finds that light, especially sunlight, causes eosin to act hæmolytically. Eosin does not increase the action of radium bromide. The hæmolysis occurs more readily at elevated temperatures.

Quite minimal additions of eosin (1:2,560,000) to ox-serum and exposure to light destroy the complement and amboceptor; with higher

concentrations, this is more rapid and complete. Agglutinins are more resistant, and precipitogens are unaffected. The photodynamic action is an oxidation process.

W. D. H.

**Action of Pepsin.** PERCY W. COBB (*Amer. J. Physiol.*, 1905, 13, 448—463).—Using Metts' tubes as a measure of peptic action, it is found that with a tube of 2.5 to 3 mm. bore, digestion is not retarded by the depth of the tube *per se* at depths of less than 7 mm. If 10 c.c. of test solution are employed containing 0.2 per cent. of hydrochloric acid and the tubes are 2 cm. long, a definite decrease in the column digested results from increasing the number of tubes placed in the solution. Making due allowances for these and other errors, pepsin solutions strong enough to digest 4 mm. or more of the columns in twenty-four hours give results far below those anticipated by Schutz' law of square roots. Below this concentration, numbers are obtained in some experiments which approximate to the rule, whilst in other experiments the figures given show no adherence to the law. The divergence is explained by the admixture of inhibitory substances usually present in preparations of pepsin, and often evident in solutions of 1/64 per cent. strength. The "albumin-froth" method of Bettman and Schroeder (*Med. Record, New York*, Oct. 31, 1903) is still less capable of quantitative exactness.

W. D. H.

**Starch Digestion in Infants.** CYRIL E. CORLETTE (*Australasian Med. Gazette*, 1905, 24, 1—8).—The clinical dictum that starch is an unsuitable food for infants is usually accompanied with instructions for the use of barley water, rice water, arrowroot, &c. Such preparations are starch-containing, and some analyses of the amount present are given. Their administration is not followed by any marked untoward results. A review of previous researches relating to the subject shows that the old idea that infants have no amylolytic ferments is incorrect, and recent work shows the adaptability of the digestive glands to varying forms of diet. At the same time, it should be recognised that there is only one proper and physiologically correct diet for the young infant, namely, its mother's milk.

W. D. H.

**End-products of Pancreatic Autolysis. IV.** FRIEDRICH KUTSCHER and LOHMANN (*Zeit. physiol. Chem.*, 1905, 44, 381—387. Compare Abstr., 1903, ii, 670, 737; 1904, ii, 425).—Further particulars as to the methods of dealing with the lysine and choline fractions are given. Thymine and uracil were not found.

W. D. H.

**The Surviving Intestine.** RUDOLF MAGNUS (*Pflüger's Archiv*, 1905, 108, 1—71).—An isolated piece of intestine suspended in oxygenated Ringer's solution continues to show its movements for many hours, and graphic records can be obtained of these by various methods which are described. The action of various drugs can then be studied. Atropine stimulates the movements by acting on Auerbach's plexus, and in large doses stops them in a condition of tonus. Nicotine acts in the contrary way. Muscarine stimulates Auerbach's plexus. Pilocarpine and physostigmine stimulate contraction in the

intestine whether the plexus is present or destroyed. The action of various other agents is also described. W. D. H.

**Influence of Sex on the Nutrition of *Bombix mori* in the Last Periods of its Metamorphosis. Localisation of Glycogen, Fat, and Soluble Albumin in the Course of Nymphosis.** C. VANEY and F. MAIGNON (*Compt. rend.*, 1905, 140, 1280—1283).—A paper similar in its scope to one already published (this vol., ii, 406). W. D. H.

**Distribution of Fat, and the Total Fat in a Fat Dog.** K. MOECKEL (*Pflüger's Archiv*, 1905, 108, 189—191).—In a fattened dog, the total fat equalled 25.9 per cent. of its weight. The skin contained 17.9, the subcutaneous tissues 30.1, the muscles 29.9, the viscera *minus* the liver 13.2, the liver 1.1, the bones 7.2, and the brain 0.37 per cent. of the total fat of the body. W. D. H.

**Creatine and Creatinine in the Organism.** WINCENTY CZERNECKI (*Zeit. physiol. Chem.*, 1905, 44, 294—308).—Instances of methylation in the body are given, and the present research is directed to determining whether guanidine is the parent substance of creatine and creatinine. The experiments consisted in giving glycocyamine (guanidine-acetic acid) to rabbits. This led to an increase of nitrogen in the urine corresponding with 62 per cent. of that in the glycocyamine, and a certain fraction of this increase is in the form of creatinine. Some reappears as glycocyamine. If creatine is given, possibly part is excreted unchanged, but this is difficult to prove with the present means of estimation; a very small part appears as creatinine, and about half as urea. Creatinine itself does not appear to be well absorbed; about half appears as such in the urine, and the amount of urea also rises. Glycocyamidine stimulates proteid katabolism; there is no increase in creatinine. W. D. H.

**The Value of the Cleavage Products of Casein in the Animal Organism.** EMIL ABDERHALDEN and PETER RONA (*Zeit. physiol. Chem.*, 1905, 44, 198—205. Compare Abstr., 1904, ii, 749; 1905, ii, 334).—Further experiments in favour of the view that proteid synthesis from simple cleavage products of proteolysis occurs in the body. Free amino-acids when administered do not reappear in the urine. W. D. H.

**Formation of Protamines in the Animal Body.** ALBRECHT KOSSEL (*Zeit. physiol. Chem.*, 1905, 44, 347—352).—A contrast is drawn between the different groupings present in various protamines, and this is followed by theoretical deductions as to the way in which the linking may be brought about within the protoplasmic molecules. W. D. H.

**Nitrogen Distribution in the Liver of the Sturgeon.** ALFRED J. WAKEMAN (*Zeit. physiol. Chem.*, 1905, 44, 341).—The following figures compare the livers of dog and sturgeon:



			Dog.	Sturgeon.
Dry substance per cent.	...	...	27.07	28.84
Nitrogen per cent. in dry substance	...	...	11.77	7.07

Nitrogen per cent. of total nitrogen :

In arginine	...	...	...	9.32	6.77
In histidine	...	...	...	2.29	1.75
In lysine	...	...	...	4.75	4.05

Quantity of these bases in 100 parts of dry substance :

Arginine	...	...	...	3.40	1.49
Histidine	...	...	...	0.99	0.46
Lysine...	...	...	...	2.90	1.49

W. D. H.

**Chemical Changes in Bone Marrow after Intraperitoneal Injection of Bacteria.** PAUL TH. MÜLLER (*Beitr. chem. Physiol. Path.*, 1905, 6, 454—480).—The composition of blood-plasma in normal rabbits is moderately constant ; the average proteid-quotient (globulin : albumin) is 1 : 1.42. The injection of different virulent but dead cultures increases the fibrinogen and the total proteid of the blood-plasma ; the serum globulin was not much affected. In the bone marrow, the total proteid and the fibrinogen were also much increased, especially by cultures of *Staphylococcus*. The fibrinogen in this situation is so great that mere admixture with blood and lymph will not account for it all ; its origin is believed to be in the marrow.

W. D. H.

**Action of Acids and Alkalis on the Staining Reactions of Animal Tissues.** ALBRECHT BETHE (*Beitr. chem. Physiol. Path.*, 1905, 6, 399—425).—A description, mainly histological, of the action of various dyes such as toluidine-blue on different tissues, and the varying intensity of the coloration when measured amounts of acid and alkali are added. The main results are represented by curves, and no general rule for different tissues appears possible. Nuclei and Nissl's granules are stainable in the presence of excess of hydrogen ions ; nerve fibres only in neutral solutions of such a dye as thiazine zinc-chloride ; that is, in the absence of free hydrogen ions, they can liberate the base from the compound. Glia tissue among others is not able to do so even in neutral solutions. A discussion on the theories of staining concludes the paper.

W. D. H.

**Fat in Human Milk.** RODOLPHE ENGEL (*Zeit. physiol. Chem.*, 1905, 44, 353—365).—The iodine number differs greatly in the milk of different women, and in individual women is subject to daily variations.

W. D. H.

**Oxidation by the Urine.** K. BERTRAM (*Pflüger's Archiv*, 1905, 108, 109—114).—If a little indigo is added to urine, and then ferrous

sulphate, the indigo is destroyed. If distilled water is used instead of urine, this does not occur. The oxidising action of the urine can also be demonstrated on arsenious acid and other substances, and can be determined quantitatively. It is attributed to the presence of hydrogen peroxide.

W. D. H.

**Iron in Diabetic Urine.** S. ZUCCHI (*Zeit. physiol. Chem.*, 1905, 44, 171—172).—Neumann and Mayer have described four cases of diabetes in which there was a constant relation between the sugar and the iron in the urine. This is important in view of the possible origin of sugar from nucleic acid. Three cases are, however, now recorded in which the proportion varied from 1·7 to 3·4 mg. iron per 100 grams of sugar.

W. D. H.

**Sugar in the Blood during Parturition in the Goat deprived of its Mammary Glands.** CH. PORCHER (*Compt. rend.*, 1905, 140, 1279—1280).—Glycosuria and glycaemia occur in the pregnant goat if the operation of ablation of the mammae has been performed. In ordinary circumstances, the sugar would no doubt have been secreted as lactose in the milk. The glycosuria, however, is not detected until delivery takes place, and disappears a few days later.

W. D. H.

**Ether-glycosuria, and the Effect of Intravenous Oxygen Infusion on it.** ALBERT SEELIG (*Chem. Centr.*, 1905, i, 1330—1331; from *Arch. exp. Path. Pharm.*, 52, 481—494).—Ether inhalations in dogs produce transient glycosuria, which is hindered by carbohydrate feeding. The glycosuria is accompanied by glycaemia and a diminution of the hepatic glycogen. Simultaneous administration of oxygen intravenously prevents the glycosuria.

W. D. H.

**Origin of the Sugar excreted in Pancreatic Diabetes.** EDUARD PFLÜGER (*Pflüger's Archiv*, 1905, 108, 115—188).—As an exclusively proteid diet for dogs, codfish was chosen; when boiled, it is free in winter and spring from glycogen and glucosides, and contains only traces of fat. Dogs without a pancreas so fed secrete in a month 30 per cent. of their body weight of sugar, or a weight greater than all the proteid of their body. The sugar must originate either from the fat or proteid of the body or of the food. In spite of the food, the body wastes "to a skeleton," only heart and brain remaining unaffected. The liver enlarges enormously to 5 per cent. of the body weight, or five times more than in ordinary starvation; it is normal in composition. In diabetics the liver is always richest in fat. There is no constant proportion between the sugar and nitrogen of the urine, and so the origin of sugar from proteid is doubted. The sugar is believed to originate in the liver cells, which are capable of turning fat as well as glycogen into sugar. The liver overgrows owing to the large amount of work it has to do in relation to proteid ingested; its sugar-forming function is simultaneously increased. Any stimulus of the liver such as ammonium carbonate or neutral soaps increases the sugar formed.

W. D. H.

**Urine in Phosphorus Poisoning.** JULIUS WOHLGEMUTH (*Zeit. physiol. Chem.*, 1905, 44, 428. Compare Abstr., this vol., ii, 338).—A supplementary note discussing the composition of arginine picrolonate, the form in which arginine was separated from the urine.

W. D. H.

**Chemical Changes in the Liver in Phosphorus Poisoning.** ALFRED J. WAKEMAN (*Zeit. physiol. Chem.*, 1905, 44, 335—340).—In phosphorus poisoning, the percentage of nitrogen in the liver substance diminishes. The amount of arginine, histidine, and lysine obtained is lessened, and is small in proportion to the total nitrogen. W. D. H.

**The Liver in Phosphorus Poisoning.** J. MEINERTZ (*Zeit. physiol. Chem.*, 1905, 44, 371—379).—According to Waldvogel (*Centr. Stoffwechsel- u. Verdauungskrankheit*, 1903, 405), protagon is present in large amounts among the fats in the livers of cases of phosphorus poisoning. In the present research on dogs, this was not confirmed; similarly, doubt is cast on estimations of jecorin.

W. D. H.

**Excretion of  $\beta$ -Naphthol in the Urine after the Administration of Small Doses of Naphthalene, Benzo-naphthol, and  $\beta$ -Naphthol.** G. EDLEFSEN (*Chem. Centr.*, 1905, i, 1341; from *Arch. exp. Path. Pharm.*, 52, 429—458).—The  $\beta$ -naphthol which appears in the urine after the administration of naphthalene is mainly combined with glycuronic acid, and to a less degree as an ethereal sulphate. After the administration of benzo-naphthol [ $\beta$ -naphthyl benzoate], it is wholly excreted as ethereal sulphate; after the administration of  $\beta$ -naphthol mainly as ethereal sulphate.  $\beta$ -Naphtholglycuronic acid is detected (1) by the red colour given by glacial acetic acid and sodium nitrite, (2) by the occurrence of  $\beta$ -naphthaquinone after treatment of the urine with hydrochloric acid and calcium chloride, and (3) by the blue fluorescence produced by adding ammonia or potassium hydroxide.

W. D. H.

**Indole and Scatole in the Organism.** PAUL GROSSER (*Zeit. physiol. Chem.*, 1905, 44, 320—334).—In dogs, Wang found that after administration of indole it reappears in the urine within 24 hours, partly as ethereal sulphates, partly as an indigo-forming substance. The present research relates to rabbits; normally their urine does not contain an indigo-forming substance; if indole is given, it is completely excreted within 48 hours; less ethereal sulphate appears than corresponds with the indole given; after feeding, about 16 per cent. reappears as indigo-forming substance; this rises to 30 per cent. after subcutaneous injection. After scatole, there is a rise in the ethereal sulphate excretion, but the general quantitative results are not so satisfactory. Some work was done in regard to the scatole pigments in the urine; one is soluble only in alcohol, another in both alcohol and acetone; the former shows the same absorption bands as urorosein.

W. D. H.

**Toxicity of Urinary Alkaloids.** H. GUILLEMARD and P. VRANCEANO (*Compt. rend.*, 1905, 140, 1277—1279).—Under normal conditions, the alkaloidal toxicity varies between 18 and 25 per cent. of



the "globale" toxicity of the urine. It is not proportional to the quantity of alkaloids, but depends on their nature. Creatinine is only slightly poisonous. Silico-tungstic acid is recommended as a suitable reagent for precipitating some of the urinary alkaloids. W. D. H.

**Selective Action of Chloroform on the Liver.** MAURICE DOYON and J. BILLET (*Compt. rend.*, 1905, 140, 1276—1277).—In certain circumstances, chloroform causes uncoagulability of the blood and disappearance of fibrinogen; this is attributed to injury of the liver. The present paper deals with the liver lesions, which are principally hæmorrhages, accumulation of polynuclear leucocytes, and hyaline degeneration of the cells. No other organ is affected except the kidney, which exhibits acute inflammation. The chloroform was administered by the stomach sound to dogs in doses of 2 grams daily per kilo. of body weight. Death usually occurs on the third day. W. D. H.

**Action of Alcohol on the Heart of Warm-blooded Animals.** OSWALD LOEB (*Chem. Centr.*, 1905, i, 1331; from *Arch. exp. Path. Pharm.*, 52, 459—480).—In weak concentration, alcohol causes sometimes a slight stimulating action on the heart; in a concentration of more than 1 per cent. its action is the reverse, culminating in stoppage. W. D. H.

**Physiological Behaviour of Methylene-blue and Methylene-azure.** FRANK P. UNDERHILL and OLIVER E. CLOSSON (*Amer. J. Physiol.*, 1905, 13, 358—371).—The evidence is insufficient that a conjugate substance is formed in the organism after the introduction of methylene-blue. The facts can be explained by the presence of two leuco-compounds or chromogens corresponding with methylene-blue and methylene-azure respectively. If pure methylene blue is introduced intravenously, intraperitoneally, or by the mouth, the following substances appear in urine and fæces: methylene-blue, methylene-azure (an oxidation product of methylene-blue), and the two chromogenic substances. If pure methylene-azure is injected, only a portion is regained, partly as such, partly as its leuco-compound. Small doses of either the blue or the azure fail to appear in the urine; it is only when oxidation is inadequate in the organism that they are manifested. The experiments were made on dogs and rabbits, and demonstrate the simultaneous action of both oxidation and reduction in the organism. W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Physiological Action of Ozone.** WILHELM SIGMUND (*Centr. Bakt. Par.*, 1905, 14, 400—415).—Two essential points in the method adopted are: (1) the ozone was prepared free from impurities; (2) the percentage of ozone mixed with air or oxygen was quantitatively determined. Quite small admixtures with ozone weaken or destroy the action of various enzymes and micro-organisms. W. D. H.

**Decomposition of Fodder and Foods by Micro-organisms.**  
**V. Composition of the Products formed by the Bacteria.** JOSEF KÖNIG, ALB. SPIECKERMANN, and FR. SEILER (*Zeit. Nahr. Genussm.*, 1905, 9, 513—528. Abstr., 1903, ii, 169, 447).—The decomposition products (slimes) examined were found to be produced by many species of bacteria not only from foods containing sugar, but also from those containing nitrogenous substances such as peptone, asparagine, and glycine. The products formed from both liquid and solid media always consisted largely, if not entirely, of anhydrides of carbohydrates. These anhydrides belonged to the lævulose and dextrose groups, and also to the galactose group. Dextran could not be detected. W. P. S.

**Bacteriological and Chemical Study of the Fermentation of Red Beet, known as "Barszcz."** KAZIMIERZ PANEK (*Bull. Acad. Sci. Cracow*, 1905, 5—49).—"Barszcz" is a fermentation caused by *Bacterium betæ viscosum* in red beet at a temperature of 18—20°. It goes on at the expense of the sucrose present in the roots, and results in the production of dextran, mannitol, acetic and lactic acids. Ester-producing bacteria have a share in the process at the commencement of the fermentation. N. H. J. M.

**The Large Bacillus observed in Flacherie.** S. SAWAMURA (*Bul. Coll. Agr. Tōkyō*, 1905, 6, 375—386).—A large bacillus, *Bacillus megatherium bombycis*, was obtained from newly-hatched silkworms and from the excreta of a young larva. The bacillus is very widely distributed, and occurs in the digestive canal of healthy insects without injuring them. When cultivated on solid media and given to silkworms, death of the latter soon follows.

Flacherie is caused by several bacteria which occur commonly on mulberry leaves. N. H. J. M.

**Effect of Various Carbohydrates and Organic Acids on the Metamorphosis of Nitrates by Bacteria.** JULIUS STOKLASA and E. VÍTEK (*Centr. Bakt. Par.*, 1905, ii, 14, 493. Compare this vol., ii, 342).—Cultures of *Bacillus Hartlebi* yielded the enzyme which gives rise to a lactic acid and alcoholic fermentation in dextrose, lævulose, sucrose, and maltose. The process goes on in presence of oxygen, as previously indicated, acetic and formic acids being produced. In absence of sodium nitrate, carbon dioxide and hydrogen are evolved, whilst when nitrate is present the hydrogen is partially oxidised to water, so that the mixture of gases consists of nitrogen, carbon dioxide, and hydrogen. N. H. J. M.

**A Case of Bacterial Deposition of Iron in a Water Supply.**

ADOLF BEYTHIEN (*Zeit. Nahr. Genussm.*, 1905, 9, 529—531).—The water supply of a small town in Saxony after passing through two kilometres of iron mains was found to contain a considerable quantity of ferruginous suspended matter, although, when drawn from the spring, the water contained no iron. A microscopical examination showed that the suspended matter consisted of a mass of threads, similar to *Crenothrix*, which were incrustated with iron oxide. These threads were in all probability *Gallionella ferruginea*, and the contamination of the supply was due to their presence, and also to the large amount of free carbon dioxide dissolved in the water. W. P. S.

**The Decomposition Phases of Milk.** C. J. KONING (*Milchw. Zentr.*, 1905, 1, 215—229).—The spontaneous decomposition of milk may be divided into eight phases or periods, in each of which one or more species of bacteria have their maximum activity. In each locality, the decomposition is governed by the bacterial flora there present. The acidity of the milk stands in relation to the activity of specific bacteria. The fungi, strictly speaking, alter the reaction of the decomposed milk, and give to certain bacteria, the functions of which have ceased, a further period of activity. In Holland, where this investigation was carried out, the lactic acid fermentation was found to be due to the growth of *Streptococcus acidilactici* Grotenfelt, *B. acidilactici* Hueppe, *B. acidiparalactici* Kozai, and *B. acidilactici* Grotenfelt, and the butyric acid fermentation to *Granulobacillus saccharobutyricus immobilis liquefaciens* Schattenfroh and Grassberger.

W. P. S.

**Some New Varieties of Mycoderma Yeast.** T. TAKAHASHI (*Bul. Coll. Agric. Tôkyô*, 1905, 6, 387—401).—Four varieties were obtained which have the property of assimilating some nitrogen from nitrites when glycerol is supplied as the source of carbon. This has not been previously observed, Beijerinck's *Saccharomycetes acetathylicus* only assimilating nitrogen as nitrates. Six varieties (including two of the above) grew in saké containing 10.77 or 13.32 per cent. of alcohol.

Most of the varieties isolated produced a distinct trace of methyl alcohol, in addition to ethyl alcohol, from koji extract. All produced acetic acid from alcohol, and some also from glycerol. Some formed butyric acid as well as acetic acid, and a few formic acid in saccharine solutions.

N. H. J. M.

**Plasmolysis and Turgor-regulation of Pressed Yeast.** N. H. SWELLENGREBEL (*Centr. Bakt. Par.*, 1905, ii, 14, 374—388 and 481—492).—The loss of glycogen, during anatonose, in cells rich in glycogen and the dying off of cells which retain glycogen support the view that yeast can regulate its turgor by decomposition of glycogen. On the other hand, cells deficient in glycogen regulate their turgor just as quickly as those containing an abundance of glycogen.

N. H. J. M.

**Further Researches on Cell-free Fermentation.** EDUARD BUCHNER and WILHELM ANTONI (*Zeit. physiol. Chem.*, 1905, 44, 206—228).—Expressed yeast juice loses its fermentative action by



exposure to the air. This was attributed to the destruction of zymase by atmospheric oxygen before it was found to be produced by the proteolytic enzyme of the juice. Certainly the presence of hydrogen instead of oxygen makes no difference in the result. Attempts to separate the zymase from the invertase of the juice by dialysis and by fractional precipitation with alcohol failed. In highly concentrated solutions of sucrose (70 per cent.), both ferments are effective. The inhibitory influence of formaldehyde, sodium fluoride, alcohol, and acetone is described with quantitative tables. Acetone is more harmful than alcohol. The favourable influence of extremely small quantities of quinine hydrochloride (described by Grigorieff) is very slight, and is perhaps due to its harmful influence on the proteolytic ferment.

W. D. H.

**Contribution to the Biochemistry of Sewage Purification; the Bacteriolysis of Peptones and Nitrates.** STEPHEN DE M. GAGE (*J. Amer. Chem. Soc.*, 1905, 27, 327—363).—Bacteria commonly occur in sewage purification, which produce ammonia and free nitrogen from organic matter, reduce nitrates, and fix free nitrogen. Probably there are also bacteria present which produce lower oxides of nitrogen. The amount of ammonia produced may be as much as 180 per million. The rate of the different actions may vary very considerably. Some cultures reduce nitrates to nitrites, ammonia, and free nitrogen continuously from the commencement; in others, the reductions occur consecutively. In some instances, the production of nitrites is greater than the amount of nitrates, indicating that oxidation is going on at the same time.

Most of the cultures reduce nitrates and produce ammonia from peptone. Many non-liquefying bacteria reduce nitrates and produce ammonia from peptone; and many liquefying bacteria exist which do not possess these functions.

N. H. J. M.

**Influence of Radium on the Respiratory Energy of Germinating Grains.** H. MICHEELS and P. DE HEEN (*Acad. Roy. Belg.*, 1905, 29—34).—See this vol., ii, 431.

**Peptone in Seeds.** WILHELM ROBERT MACK (*Bied. Centr.*, 1905, 34, 226—229; from *Inaug. Diss. Leipzig*, 1903. Compare *Abstr.*, 1904, ii, 762).—Resting seeds of lupins contain considerable amounts of peptone. The vegetable peptone resembles Siegfried's peptonic acids. It is a dibasic acid having a characteristic barium salt.

N. H. J. M.

**Action of Ethyl Ether and Chloroform on Dry Seeds.** PAUL BECQUEREL (*Compt. rend.*, 1905, 140, 1049—1052).—Entire seeds which were kept a year in chloroform or ethyl ether retained their germinating power, whilst seeds the tegument of which had been perforated or partially removed were destroyed. Both substances dissolved the fatty substances of the cell, but chloroform produced further changes extending to the proteids.

N. H. J. M.

**Chemotropism of the Root.** MAURICE LILIENFELD (*Chem. Centr.*, 1905, i, 1328—1329; from *Ber. deut. bot. Ges.*, 23, 90—96).—The rootlets of lupin seedlings were allowed to grow into gelatin, to which various substances were added; positive curvatures were produced by

disodium hydrogen phosphate, ammonium phosphate, potassium carbonate, and potassium dihydrogen phosphate; negative curvatures by sodium chloride, magnesium sulphate, ferric nitrate, aluminium nitrate, copper sulphate, copper chloride, zinc sulphate, lead nitrate, mercuric nitrate, and mercuric chloride. Potassium carbonate and nitrate are either indifferent or partly positive. W. D. H.

**Chlorophyllous Assimilation in Young Shoots of Plants.** Application to the Vine. ED. GRIFFON (*Compt. rend.*, 1905, 140, 1148—1151).—Experiments with young leaves attached to stems showed that assimilation may be very feeble, and is easily masked by respiration.

Young leaves, especially of vine, were found to be free from starch. The parasitism of the tops of vines is very feeble when it exists at all, which is not the case when one or two well-developed leaves are present. N. H. J. M.

**Composition of Solid Fats of Plants.** ISIDOR KLIMONT (*Monatsh.*, 1905, 28, 563—569. Compare Abstr., 1901, i, 663; 1902, i, 340; 1903, i, 731; this vol., ii, 126).—Oleodistearin (Henriques and Künne, Abstr., 1899, i, 330) has now been found in *oleum stillingiae* and in cacao fat, which melts at 32·5° and has an acid number 1·7, an iodine number 35·4, and a saponification number 196·5.

Oleodipalmitin, obtained from cacao fat, from *oleum stillingiae*, or from Borneo tallow, melts at 38° (m. p. 33—34°; this vol., ii, 126).

All the glycerides found in vegetable fats are hydrolysed with relative difficulty, and are stable towards atmospheric action.

G. Y.

**Formation and Rôle of Fatty Substances in Fungi.** A. PERRIER (*Compt. rend.*, 1905, 140, 1052—1054).—Experiments with different fungi showed that the fatty substances increase from the commencement and may amount to 30 per cent. or more of the dry matter. The amount remains about constant in presence of an excess of nutritive substances, but diminishes when these are deficient.

N. H. J. M.

**Chrysanthemums.** II. ALEXANDRE HÉBERT and GEORGES TRUFFAUT (*Bull. Soc. chim.*, 1905, [iii], 33, 661—664. Compare Abstr., 1903, ii, 608; 1904, ii, 140).—From analyses of the mineral constituents of chrysanthemums made when the flower-buds first appear, towards the end of July, and when the first flowers open, early in October, it is found that far more mineral matter is absorbed by the plant during the last 64 days of growth than during the first 178 days. During the first period, chrysanthemums absorb from the soil 1·42 units of potash and 0·28 units of phosphoric acid for each unit of nitrogen, and during the second period 1·23 units of potash and 0·47 units of phosphoric acid for each unit of nitrogen. This indicates that manures should be applied at the end of August, and that they should contain the three essential constituents in the above proportions.

T. A. H.

**Chlorosis of Plants.** A. DOMENTÉEFF (*Bied. Centr.*, 1905, 34, 185—186; from *J. exper. Landw.*, 1903, 4, 733).—Chlorose is attributed to an excess of salts in the leaves caused by injury to the roots by parasites or by digging the surrounding soil. The accumulated mineral matter closes the pores of the leaves and hinders the production of chlorophyll, whilst the chlorophyll already formed is destroyed by the action of light.

N. H. J. M.

**Physiological Effects of Ozone.** WILHELM SIGMUND (*Centr. Bakt. Par.*, 1905, ii, 14, 494—502).—Ozone retards the curdling of milk, but not sufficiently to be of use as a preservative. The employment of larger amounts of ozone would cause alterations in the composition of the milk. The rapid curdling of milk during thunderstorms cannot be due to ozone, and is undoubtedly due in part to the higher temperature which prevails. It is suggested that the nitrous acid and oxides of nitrogen produced in storms may have something to do with it.

Mycoides and nodule-bacteria, when ozonised for an hour (with 1.2 mg.  $O_3$ ), were not killed, but their development was retarded.

Small amounts of ozone were found to be beneficial to the germination of peas, whilst larger amounts were injurious.

N. H. J. M.

**The Reactions of Living Cells to Very Dilute Solutions of Various Substances.** THOMAS BOKORNY (*Pflüger's Archiv*, 1905, 108, 216—236).—Solutions of various substances were made of 0.1 per cent. strength; this was diluted down 10, 100, 1000, &c., fold, and one of the remarkable points brought out is the intensely poisonous action of the materials used on animal and vegetable cells; the more dilute the solution, the longer is the time required for this to manifest itself. In some cases (mercuric chloride, copper sulphate, and other salts of heavy metals), this is attributed to compounds which are formed between the poisons and the proteid matter of the protoplasm. In others (ammonia, caffeine, and other organic bases), the poisons act as stimuli, the histological sign of which is "aggregation" of particles in the protoplasm.

W. D. H.

**Effect of Rust on the Straw and Grain of Wheat.** FRANK T. SHUTT (*J. Amer. Chem. Soc.*, 1905, 27, 366—369).—Rusted straw contains increased percentages of crude proteid and fat. In rusted grain, the proteids are 3.19 per cent. higher than in normal grain; the fibre and ash are also higher, whilst water, carbohydrates, and fat are lower.

Whilst rust results in the production of a more nitrogenous grain, it also considerably reduces the total yield. In the present case, the yield was reduced by about 50 per cent. The proportion of flour to bran is also reduced, presumably.

N. H. J. M.

**Influence of Stimulants on the Consumption of Food. Digestibility and Secretion of Milk with Non-stimulating and Normal Food.** GUSTAV FINGERLING (*Landw. Versuchs-Stat.*, 1905, 62, 11—180).—When added to a food entirely free from stimulant,



the effect of stimulants is to increase the consumption of food and the yield of milk and milk constituents. When, however, stimulants are added to a normal food (which contains stimulating substances), no effect is produced.

In practice, the use of stimulants is only of use in exceptional cases, such as, for instance, when cattle are fed with hay damaged by rain. In such cases, addition of fenugreek, anise, or caraway seed is recommended (compare J. B. Lawes, *Edinb. Vet. Rev.*, 1862; *Rothamsted Memoirs*, 2, No. 16). N. H. J. M.

**Composition of Milan Milk.** C. BERTOCCHI (*Milchw. Zentr.*, 1905, 1, 211—215).—Further results are given showing the composition of the milk of Milan and surrounding districts (*Abstr.*, 1905, ii, 361). The milks contained frequently less than 12 per cent. of total solids, the minimum quantity found being 11·6 per cent. The lowest percentage of non-fatty solids observed was 8·08. W. P. S.

**Experiments on the Accumulation and Utilisation of Atmospheric Nitrogen in the Soil.** EDWARD B. VOORHEES and JACOB G. LIPMAN (*J. Amer. Chem. Soc.*, 1905, 27, 556—589).—Experiments were made in boxes with cow-peas without nitrogen and with different nitrogenous manures. The cow-peas were followed by two crops of millet.

The results showed that the soils gained nitrogen during the growth of cow-peas, and there are indications that fixation of nitrogen in the soil continued after the removal of the cow-peas. In soils supplied with organic matter, there was considerable fixation of nitrogen; soils, however, with which large amounts of a leguminous crop were incorporated did not show a gain of nitrogen. The conclusion is drawn that non-symbiotic fixation of nitrogen is most active in open soils with fairly large amounts of organic matter having a low percentage of nitrogen. N. H. J. M.

**Preservation and Action of the Nitrogen of Urine.** E. BÖHME (*Bied. Centr.*, 1905, 34, 300—304; from *Illust. landw. Zeit.*, 1904, 24).—Gypsum (10 per cent.) reduced the loss of nitrogen to 7 per cent. in 250 days, urine alone losing 56 per cent. of its nitrogen in the same time. Sulphuric acid (1 per cent.) reduced the loss to 5·5 per cent., whilst with 2 per cent. of sulphuric acid the whole of the nitrogen was retained.

The results of manurial experiments showed that addition of lime and gypsum increased the action of urine, and that in presence of these substances and sulphuric acid the nitrogen of urine had better effects when applied before the seed than as top-dressing.

The nitrogen of urine is almost equal in value to that of sodium nitrate. N. H. J. M.

**Action of Calcium Cyanamide.** WILLY ZIELSTORFF (*Bied. Centr.*, 1905, 34, 217—218; from *Illust. landw. Zeit.*, 1904, 24, 1103).—The results of pot experiments with mustard showed that when calcium cyanamide was applied at the same time as the seed its value was 88·4 per cent.

of that of sodium nitrate. When the seed was sown 10 days after the application of the manure, the value of the latter increased to 92.8 per cent. Ammonium salts give less favourable results.

Results obtained with a second crop showed that calcium cyanamide had no appreciable after effect. The manure should not be applied as a top-dressing.

N. H. J. M.

**Fruit Tree Manures.** H. CLAUSEN (*Bied. Centr.*, 1905, 34, 219—221; from *Landw. Jahrb.*, 33, 939—960).—Kainite and basic slag (1 kilo. per tree) applied in April injured apple trees, the injurious effects lasting for three years. Marl had a beneficial effect and in many cases diminished injury due to kainite and basic slag. Nitrogenous manures promote the formation of wood, whilst the exclusive use of mineral manures restricts wood-production. Ammonium sulphate proved to be beneficial and much preferable to sodium nitrate.

N. H. J. M.

**Calcium Nitrate in Agriculture.** E. S. BELLENOUX (*Compt. rend.*, 1905, 140, 1199).—Potatoes manured with calcium nitrate produced tubers containing 1.8 per cent. more starch than those manured with sodium nitrate. Similar experiments with sugar-beet showed an increase of 1.37 per cent. of sugar with calcium as compared with sodium nitrate.

The calcium nitrate was prepared by the action of sodium nitrate on calcium chloride, the sodium chloride produced separating during the concentration.

N. H. J. M.

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## Analytical Chemistry.

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**New Apparatus for Gas Analysis.** GINO POLLACCI (*Ann. Chim. anal.*, 1905, 10, 169—170).—A rather complex apparatus for gas analysis, suitable for the analysis of the gases obtained in experiments on vegetation; for the details, the original must be consulted.

L. DE K.

**New Method for the Estimation of Mixtures of Chlorides, Iodides, and Bromides.** O. WENTZKI (*Zeit. angew. Chem.*, 1905, 18, 696—698).—A modification of the well-known indirect silver process based on the fact noticed by the author that iodides and bromides are converted into chlorides by adding excess of mercurous chloride and also that an iodide is converted into bromide by means of mercurous bromide.

In the case of a mixed chloride and iodide, a portion of the liquid is precipitated with silver nitrate and the precipitate is collected and weighed as usual ( $\text{AgCl} + \text{AgI}$ ). An equal volume of the liquid which has been shaken with a large excess of precipitated mercurous chloride

is then also precipitated (AgCl). From the two weights obtained, the result may be calculated in the well-known manner. Chlorides and bromides are treated in the same manner, the respective precipitates being  $\text{AgBr} + \text{AgCl}$  and  $\text{AgCl}$ . In the case of a bromide and iodide, mercurous bromide is employed, the respective precipitates being  $\text{AgBr} + \text{AgI}$  and  $\text{AgBr}$ . In case all three halogens are present, one portion is precipitated directly, a second portion after treatment with mercurous chloride, and a third after treatment with mercurous bromide, the results being respectively  $\text{AgCl} + \text{AgBr} + \text{AgI}$ ,  $\text{AgCl} + \text{AgBr}$ , and  $\text{AgCl}$ .

L. DE K.

**Estimation of Oxygen in Copper.** S. DICKSON (*Analyst*, 1905, 30, 145—147).—Ten grams of the copper, in one piece, and 20 grams of tin (previously fused in an atmosphere of hydrogen) are placed in a boat and heated in a porcelain tube until complete fusion has taken place, dry hydrogen being passed through the apparatus. The water formed is caught in an ordinary sulphuric acid U-tube. The results obtained are usually slightly higher than those yielded when the copper itself is fused without the addition of tin.

W. P. S.

**Iodometric Estimation of Sulphurous Acid.** ERWIN RUPP (*Ber.*, 1905, 38, 1903—1905. Compare Abstr., 1903, ii, 40).—In reply to Ruff and Jeroch's criticisms (this vol., ii, 200), it is pointed out that whereas these authors added the iodine solution to the sulphurous acid solution containing sodium hydrogen carbonate, Rupp added the sulphite solution to the iodine solution containing sodium hydrogen carbonate. Under the later conditions, neither the oxidising influence of the air nor the formation of sodium hypiodite introduces an error, and the method gives satisfactory results.

E. F. A.

**Detection of Free Yellow Phosphorus in Phosphorus Sulphide.** LÉO VIGNON (*Compt. rend.*, 1905, 140, 1449—1451).—The presence of free yellow phosphorus in commercial phosphorus sulphide cannot be readily detected by the ordinary methods; Mitscherlich's test fails because the pure sulphide  $\text{P}_4\text{S}_3$  is partially decomposed when distilled with water; also the pure sulphide and the commercial compound each boil at  $250$ — $254^\circ$  under 30 mm. pressure, whilst mixtures of the pure sulphide with 2.64 or 1.80 per cent. of yellow phosphorus boil at  $160$ — $260^\circ$  and  $250^\circ$  respectively; if, however, a current of pure hydrogen is passed over the suspected compound, the issuing gas is luminous and burns with a green flame in the presence of free yellow phosphorus.

M. A. W.

**Estimation of Phosphoric Acid by the Citrate Method; a Source of Error hitherto overlooked and a Modification for avoiding it.** VINCENT SCHENKE (*Landw. Versuchs-Stat.*, 1905, 62, 3—10).—In the usual citrate method, 50 c.c. of the acid phosphate solution ( $= 0.5$  gram of substance) are treated with 100 c.c. of citrate solution and 25 c.c. of magnesia mixture. The following modification is proposed. The solution (50 c.c.) is nearly neutralised with ammonia, quickly cooled, and treated with 50 c.c. of citrate solution and 25 c.c.



of magnesia mixture. It is then stirred for half an hour and filtered after several hours. A number of results are given showing close agreement with the molybdate method (Maercker), whilst the method of the German Association gave, in every case, lower results, owing to the greater solubility of the magnesium ammonium phosphate in the citrate solution, which had been altered from that originally proposed by the addition of a considerable amount of acid. N. H. J. M.

**Separation of Arsenic.** H. CANTONI and J. CHAUTEUS (*Arch. Sci. phys. nat.*, 1905, [iv], 19, (4), 364—366).—When a current of air is passed through a hydrochloric acid solution of arsenic trioxide containing methyl alcohol, the arsenic is completely removed at the ordinary temperature in the form of its methyl ester, whilst antimony compounds are not volatile under these conditions. M. A. W.

**Detection of Boric Acid [in Foods].** O. VON SPINDLER (*Chem. Zeit.*, 1905, 29, 566—567).—Boric acid may be detected by the turmeric reaction if care is taken to use properly prepared turmeric paper. The flame reaction as usually applied is less trustworthy, even if methyl alcohol is substituted for ethyl alcohol. The following modification of the flame test gives satisfactory results.

Five to ten grams of the comminuted substance are rubbed in a mortar with 5 drops of dilute sulphuric acid (1 : 4) and introduced into a flask containing 30—40 c.c. of strong methyl alcohol. The flask is heated in a water-bath at 70—75° and a current of coal gas is passed through. If this should now burn with a green flame, boric acid is undoubtedly present. L. DE K.

**Electrical Method for the Combustion of Organic Compounds.** HARMON N. MORSE and L. S. TAYLOR (*Amer. Chem. J.*, 1905, 33, 591—603).—An electrical method is described for the estimation of carbon and hydrogen in organic compounds which is said to have the following advantages. The apparatus is small and compact, the waste of heat energy is much smaller than that of the ordinary method, and the time required in preparing for and carrying out a combustion is considerably reduced.

Two forms of apparatus are described. The first of these consists of a thin glass combustion tube, 350 mm. long, 15 mm. in internal diameter, and closed at one end. The open end is fitted with a caoutchouc stopper through which pass a porcelain tube, 250 mm. long and 6 mm. in diameter, a glass tube conveying the products of combustion to the absorption apparatus, and a thick platinum wire. The platinum wire is connected inside the combustion tube to a finer platinum wire which surrounds the porcelain tube in a spiral coil and finally passes down through the porcelain tube to the exterior, the lower part being composed of thicker wire. The oxygen or air is led into the combustion tube through a glass side-tube, which is attached to the porcelain tube outside the stopper by means of india-rubber tubing.

In carrying out a combustion, the boat containing the substance is placed at the closed end of the tube, a roll of copper gauze about

60 mm. long is placed next, the india-rubber stopper carrying the tubes and platinum wire is inserted, and the glass delivery tube is attached to the absorption apparatus. Pure dry oxygen is passed slowly through the tube and the electric circuit is closed through a regulating rheostat. The current is increased until the wire becomes red-hot, and the roll of copper gauze and the boat containing the substance are then heated by means of a gas flame. The time required for a combustion is usually about half an hour. The amount of electrical energy consumed is about 3.6 amperes at 54 volts during the time when the highest temperature is maintained.

The second form of apparatus described differs in being composed of a somewhat longer combustion tube which is open at both ends. Both forms of apparatus are fully described with the aid of diagrams.

The results of a series of combustions are quoted for the purpose of illustrating the applicability and accuracy of the method, and an account is given of the precautions which must be observed in the combustion of substances containing nitrogen, halogens, or sulphur.

E. G.

**A Quick-acting Potash Apparatus.** GUSTAV SCHÖLER (*Chem. Zeit.*, 1905, 29, 569—570).—The pear-shaped inner vessel, *I*, is partly filled

with a solution prepared by dissolving 5 grams of curd soap in 150 c.c. of hot water and 50 grams of potassium hydroxide. The carbon dioxide generated in the combustion is very rapidly absorbed, and may be passed at a much more rapid rate than usual, as the absorption is accelerated by the lather formed. The unabsorbed gases now pass into the outer vessel, *II*, containing a little of a solution of 100 grams of potassium hydroxide in 100 c.c. of very hard water, to which, if necessary, a little calcium chloride may be added. They finally escape through the calcium chloride tube.



L. DE K.

**Assay of Salpetre.** R. BENSEMANN (*Zeit. angew. Chem.*, 1905, 18, 816).—A weighed portion of the sample is dissolved in water, mixed with at least twice its weight of oxalic acid, and evaporated to dryness on the water-bath. The dry mass is then moistened with water and again evaporated, and this operation is repeated several times.

In this way, the nitrate is completely converted into oxalate; any chlorides are similarly decomposed, but perchlorates and sulphates are not affected. If now the mixture is gradually heated to redness, the mass will contain potassium (or sodium) carbonate derived from the nitrate and any chloride, and also potassium chloride due to the perchlorate.

The alkali carbonate is now estimated in an aliquot part of the solution by titration with standard acid and, after allowing for the chloride, estimated in another portion of the sample, the nitrate is calculated. The chlorine which is estimated in another portion of the solution represents the perchlorate. A third portion may be used for estimating any sulphate.

L. DE K.

**Rapid Estimation of Calcium, Potassium, and Phosphoric Acid.** ERNST H. SCHULTZE (*Chem. Zeit.*, 1905, 29, 508—509).—*Estimation of Calcium in Limestones, Mortars, &c.*—The substance is dissolved in dilute hydrochloric acid with addition of a little nitric acid. After boiling with a slight excess of ammonia, the cold liquid is diluted to a definite volume, and an aliquot part, after acidifying with acetic acid, is precipitated with a known weight of ammonium oxalate. The excess of oxalate is then determined in an aliquot part of the filtrate. In the presence of decided quantities of phosphoric acid, the ammoniacal precipitate is redissolved by means of hydrochloric acid, and, after adding a little ferric chloride, the phosphoric acid and the excess of iron are precipitated by boiling with sodium acetate. After again boiling with a little ammonia, the filtrate is treated as already directed.

*Estimation of Potassium in Kainites, &c.*—The sample is boiled with dilute hydrochloric acid (1:25) and carefully precipitated with barium chloride. An aliquot part of the filtrate (=about 0.4 gram of the sample) is then treated with 0.5 c.c. of platinic chloride (1:10) and then gradually with 120 c.c. of hot 96 per cent. alcohol. Mechanical stirring is resorted to for about 20 minutes, when the precipitate is collected on a Gooch filter, washed with alcohol, finally with ether, and dried at 120°.

*Volumetric Estimation of Phosphoric Acid.*—Pemberton's process is recommended. The aqueous or sulphuric acid solution of the phosphate is neutralised with potassium hydroxide, acidified with nitric acid, mixed with ammonium nitrate, and heated to 80°. The phosphoric acid is then precipitated with ammonium molybdate, and the yellow precipitate is collected and washed first with 1 per cent. nitric acid, and then twice with cold water. The precipitate is then dissolved in a known volume of standard potassium hydroxide, the excess of which is titrated with standard hydrochloric acid, using phenolphthalein as indicator.

L. DE K.

**Solubility of Lime and Magnesia in Solutions of Sodium Chloride with or without Sodium Hydroxide. Application to the Separation and Estimation of the Two Substances.** E. MAIGRET (*Bull. Soc. chim.*, 1905, [iii], 33, 631—634).—The author finds that whilst lime is fairly soluble, magnesia is insoluble in solutions containing up to 160 grams per litre of sodium chloride in presence of 0.8 gram per litre of sodium hydroxide. This difference has been utilised in extending and rendering more accurate D'Anselme's method of estimating lime and magnesia (*Abstr.*, 1903, ii, 695). One hundred c.c. of the liquid are placed in a 200 c.c. flask, and 20 c.c. of a solution containing sodium carbonate (100 grams per litre) and sodium



hydroxide (20 grams per litre), the equivalent of which in 2*N*-hydrochloric acid is known, are added. The mixture is heated to boiling, then cooled and made up to 200 c.c. with a solution of sodium chloride (160 grams per litre). The mixture is shaken and filtered and 100 c.c. of the filtrate titrated with 2*N*-hydrochloric acid using tropeolin as indicator. The difference between twice the burette reading and the equivalent of the alkaline solution added is equal to the total magnesia and lime present in terms of 2*N*-hydrochloric acid.

For the estimation of the magnesia alone, 100 c.c. of the solution are mixed with 10 c.c. of a solution of sodium hydroxide (80 grams per litre), diluted to a litre with a solution of sodium chloride (160 grams per litre), and, after shaking, filtered and 500 c.c. of the filtrate titrated with 2*N*-hydrochloric acid, using phenolphthalein as indicator. The difference between the burette reading multiplied by 2 and the titre of the sodium hydroxide solution added is equivalent to the magnesia present. The difference between this and the first estimation gives the equivalent of the lime present.

T. A. H.

#### Estimation of Lead by Persulphate in Acid Solution.

MAX DITTRICH and A. REISE (*Ber.*, 1905, 38, 1829—1831).—When ammonium persulphate solution is added to a solution of a lead salt, the lead is quantitatively precipitated as white crystals, which darken when the liquid is heated at 80° for 3 hours in presence of a little silver nitrate, the precipitate then consisting of a mixture of lead oxide and peroxide together with a small quantity of lead sulphate. The precipitate is washed with a 3 per cent. solution of ammonium sulphate and is converted into lead sulphate by igniting with a drop of sulphuric acid. The best precipitant consists of a 2 per cent. ammonium persulphate solution containing a trace of silver nitrate; this should be heated to 80° and the lead solution added to it drop by drop.

T. H. P.

**Estimation of Copper and Free Matte in Dross.** VALLETY (*Ann. Chim. anal.*, 1905, 10, 193).—Five grams of the dross are treated with 109 c.c. of a 5 per cent. solution of silver nitrate and 5 c.c. of nitric acid are added. After 24 hours, the solution is filtered and the copper estimated by the usual process.

L. DE K.

**Mass Analyses of Muntz Metal by Electrolysis.** Electrolytic Properties of the Alloy. JOHN G. A. RHODIN (*Trans. Faraday Soc.*, 1905, 1, 119—135).—The paper contains the results of experiments to find a method for the accurate estimation of the copper in Muntz metal of sufficient rapidity to give about 100 determinations daily within 12 hours of the time of casting. The method adopted was an electrolytic method, for which the author claims an accuracy of 0.07 per cent. and the necessary speed and ease of working. The experimental details are given. For Muntz metal to be a successful ship sheathing it is necessary that it should dissolve electrolytically in sea-water to a sufficient extent to render the surface poisonous, but sufficiently slowly to make its use economical, and the best result will

be obtained when the two components of the alloy dissolve at equal rates. Assuming the rate of dissolution to be directly proportional to the heat of formation of the ultimate compounds and to the electrical conductivity of the dissolving metal, the author obtains theoretically the proportion 60.8 Cu, 30.2 Zn as that of the best alloy, a result in accord with practical experience. The results of experiments on the rate of dissolution are appended, and it is seen that barometric pressure has a considerable effect on the velocity of dissolution. L. M. J.

**Titrimetric Method of Estimating Mercury.** ERWIN RUPP (*Arch. Pharm.*, 1905, 243, 300—302).—A few c.c. of formaldehyde solution (about 35 per cent.) are made alkaline with dilute aqueous alkali hydroxide, a suitable quantity of the mercury solution is added, and the mixture is shaken and warmed for 10—15 minutes on the water-bath. The liquid is then acidified with plenty of acetic acid, a suitable volume of  $N/10$  iodine solution is added, the flask is corked and shaken gently for 5 minutes or so (until the precipitate of metallic mercury has all gone into solution as potassium mercuri-iodide), and the excess of iodine is titrated with  $N/10$  thiosulphate in the presence of starch solution. Each 1 c.c. of the  $N/10$  iodine solution used = 0.01002 gram of mercury or 0.01355 of mercuric chloride. The method is applicable in the presence of chlorides, unlike the titration with thiocyanate solution. C. F. B.

**Standardisation of Potassium Permanganate Solutions by means of Silver.** KARL HOPFGARTNER (*Monatsh.*, 1905, 26, 469—482).—A weighed amount of silver is dissolved in a solution of ferric ammonium sulphate acidified with sulphuric acid, and the ferrous salt so formed titrated with the potassium permanganate solution to be standardised. G. Y.

**Estimation of Ferric Oxide in presence of much Alumina.** ERNST DEUSSEN (*Zeit. angew. Chem.*, 1905, 18, 815—816).—The usual plan is to fuse the strongly ignited and weighed mixed oxides with potassium pyrosulphate. The mass is then dissolved, the iron is reduced to the ferrous state and titrated with permanganate. In order to save time and prevent damage to the platinum crucibles, which are attacked by potassium pyrosulphate, the author prefers fusing with about 1 gram of potassium hydrogen fluoride instead. After fusing for a few minutes over a small Bunsen flame, the mass turns solid. The bulk of the hydrogen fluoride is now expelled by heating with dilute sulphuric acid, and the resulting solution is treated as usual. L. DE K.

**Electrolytic Estimation of Molybdenum.** ALBERTO CHILESOTTI and A. ROZZI (*Gazzetta*, 1905, 35, i, 228—236).—For the electrolytic estimation of molybdenum in solutions of molybdates (compare Kollock and Smith, *Abstr.*, 1901, ii, 694), the concentration of the sulphuric acid in the solution should not be less than  $N/100$  nor more than  $N/10$ , the percentage of molybdenum trioxide in the form of ammonium molybdate being about 0.1. The presence of salts of the

alkali metals, such as potassium sulphate or nitrate or sodium sulphate, leads in some cases to high results, the alkali being to some extent precipitated with the molybdenum. In presence of small quantities of salts of the alkali metals (less than 0.75 per cent. of  $K_2SO_4$ ), this inaccuracy may be avoided by acidifying the solution with 0.4—0.5 per cent. of sulphuric acid. With larger quantities of salts of alkali metals, it is necessary to convert the precipitated molybdenum trioxide into ammonium molybdate, acidify the solution of the latter with 0.4—0.5 per cent. of sulphuric acid, and reprecipitate the molybdenum electrolytically. When the alkali metals have also to be estimated, this must be done in the combined residual liquors from the two electrolyses. The precipitate of molybdenum trioxide is more easily dealt with when it is deposited in a matt platinum vessel.

T. H. P.

#### Estimation of Gold and Platinum by means of Magnesium.

FRANZ FAKTOR (*Chem. Centr.*, 1905, i, 1305—1306; from *Pharm. Post*, 38, 175. Compare this vol., ii, 455).—When a solution of gold chloride is boiled with magnesium ribbon until the solution is colourless and a fresh piece of ribbon is no longer tarnished, the gold separates completely in the form of brownish-yellow flakes, and may be weighed in a pure form after dissolving the excess of magnesium in hydrochloric acid. In the case of gold alloys, the excess of acid must be removed before adding the magnesium, and the metals which are precipitated with the gold must be removed by the action of a suitable acid. The same method may be used for the separation of platinum from the brownish-yellow solution of the chloride.

E. W. W.

**Reaction of Rhodium.** EUGENIO P. ALVAREZ (*Compt. rend.*, 1905, 140, 1341—1343; *Chem. News*, 1905, 91, 216).—Excess of sodium hydroxide is added to an aqueous solution of a rhodium salt to produce an alkaline solution of rhodium sesquihydroxide,  $Rh(OH)_3 \cdot H_2O$ . Into this is passed the gas evolved by the action of hydrochloric acid on potassium chlorate. The liquid becomes yellowish-red, then red, and finally a slight green precipitate forms and redissolves in the liquid yielding a blue solution (Claus' blue), due to the production of sodium pererrhodate,  $Na_2RhO_4$ . The colour is insoluble in ether or benzene, and is destroyed by sulphur dioxide, sodium peroxide, or sodium persulphate.

T. A. H.

**Mineralogical Analysis of Soils.** J. DUMONT (*Compt. rend.*, 1905, 140, 1111—1113).—Soils which contain much vegetable matter are triturated in a 60 per cent. solution of calcium nitrate which has a sp. gr. greater than that of humus. The soil is then boiled with oxalic acid in such quantity that 10 per cent. (of the weight of the soil) remains after all the calcium carbonate is decomposed. (Or the calcium carbonate may be decomposed by mineral acids before treatment with oxalic acid.) The heating in a salt-bath is continued for an hour. It is then filtered, washed first with water containing nitric acid to remove the calcium oxalate, and then with distilled water, after which it is digested for a day or two with an ammoniacal



solution which dissolves the humus. Sand and silicates are removed centrifugally, the clay remaining in suspension whilst the sand settles. Half an hour, at the rate of 1000 rotations, generally suffices. The liquid is poured off, fresh ammoniacal water added, and the process repeated. This is continued until a clear liquid remains. The sand is then collected and may be separated into fractions of different degrees of fineness by sieves.

Different mineral constituents—mica, felspar, and quartz, &c.—are separated by means of liquids of different densities (mercuric iodide dissolved in potassium iodide, methylene iodide with varying amounts of xylene, &c.) in conjunction with centrifugalising.

N. H. J. M.

**A Filter Funnel for the Estimation of Paraffin in Mineral Oil Distillates.** JULIUS FLEISCHER (*Chem. Zeit.*, 1905, 29, 489).—The apparatus consists of a cylindrical porcelain funnel, destined to contain a Soxhlet extraction capsule, which is surrounded by a larger funnel containing a freezing mixture at  $-18^{\circ}$  to  $-20^{\circ}$ , thus enabling the liquid to be filtered at a low temperature. It is claimed for the apparatus, which is in one piece, that by its use 8 to 10 estimations can be performed in the time usually required for one.

P. H.

**Refractometric Analysis of Beer.** EDWIN ACKERMANN (*Ann. Chim. anal.*, 1905, 10, 171—178).—The beer is well shaken to deprive it of its carbon dioxide and is passed through a filter. The sp. gr. is then very carefully taken at  $15^{\circ}$  and also its refraction at  $17.5^{\circ}$ , using a Zeiss immersion refractometer.

By means of a disc-shaped calculating machine, fully described and illustrated in the original article, both the percentage of alcohol and extract may be readily ascertained.

L. DE K.

**Some Conditions affecting the Ester Value of Brandy.** PHILIP SCHIDROWITZ and FREDERICK KAYE (*Analyst*, 1905, 30, 149—152).—The authors found that ordinary tap-water, such as the New River supply, when used for "breaking down" brandy, caused a decrease of 15 per cent. or more in the ester value other than that due to the dilution. This water also appreciably affected the acid value of the brandy. An examination of new brandy bottles showed that in some cases the bottles yielded a distinct quantity of alkali to distilled water. The total acid in a blended brandy was found to be by no means necessarily equivalent to the theoretical mean of the constituents. Blending also affected the ester value, the deviations from the mean being, in a few instances, quite appreciable.

W. P. S.

**Estimation of Higher Alcohols in Spirits. I.** PHILIP SCHIDROWITZ and FREDERICK KAYE (*Analyst*, 1905, 30, 190—197).—The Beckmann process (*Abstr.*, 1902, ii, 178) was found to give untrustworthy results, the fault lying in the actual extraction and not in the nitration part of the process. In the Allen-Marquardt method, a certain quantity of ethyl alcohol remained in the carbon tetrachloride extract, but for some unexplained reason disappeared during the oxidation with the

chromic acid mixture. It was not converted into acetic acid, and the authors suggest that it was either oxidised into carbon dioxide and water or formed a neutral ester with the mineral acid present.

W. P. S.

**Colour Reactions of Pyruvic Acid with  $\alpha$ - and  $\beta$ -Naphthols in Sulphuric Acid Solution.** EUGENIO P. ALVAREZ (*Chem. News*, 1905, 91, 209).—When pyruvic acid is added to  $\beta$ -naphthol dissolved in strong sulphuric acid, a red coloration is produced, which, when gently warmed, becomes deep blue; on addition of water or alcohol a fugitive yellow colour is obtained. With  $\alpha$ -naphthol under similar conditions, the first solution is yellow, changing to a deep orange varnish when warmed and spread over the capsule employed; the colour is not changed by water.

D. A. L.

**Volumetric Estimation of Reducing Sugars.** ARTHUR R. LING and THEODORE RENDLE (*Analyst*, 1905, 30, 182—190).—To ascertain the exact end-point when a sugar solution is titrated with Fehling's solution, the use of ferrous thiocyanate as an indicator is recommended. This is prepared by dissolving 1 gram each of ferrous ammonium sulphate and ammonium thiocyanate in 10 c.c. of water at a temperature of 45—50°, cooling immediately, and adding 50 c.c. of concentrated hydrochloric acid. If the solution has a reddish-brown colour, due to the presence of ferric salt, the latter is reduced by the addition of a little zinc-dust. When a drop of the titration liquid is brought into contact with a drop of the indicator, a red coloration is produced as long as cupric salt is present. Examples are given of estimations of invert sugar, dextrose, maltose, molasses, &c., showing that the method is capable of a high degree of accuracy.

W. P. S.

**Use of the Orcinol Reaction for the Detection of Sugar in Urine.** GUIDO MANN (*Chem. Centr.*, 1905, i, 1438; from *Berl. klin. Woch.*, 42, 231—232).—Neumann (*Berl. klin. Woch.*, 41, No. 41) has used a modification of the orcinol reaction to distinguish between the hexoses. This may be used with great advantage in the investigation of urine. In slight cases of diabetes, the dextrose colour test with orcinol is successful where other tests fail; 0.1 per cent. can be detected easily. The reaction for lævulose is sharp, and the detection of lævulosuria easy. Albumin, if present in the urine, should be removed before applying the test.

W. D. H.

**Estimation of Maltose or Dextrose in presence of Starch Paste.** JULES WOLFF (*Ann. Chim. anal.*, 1905, 1, 193—195).—The estimation of maltose in the presence of non-liquefied starch presents some physical difficulties. The author has succeeded in overcoming these by liquefying this starch by heating for 7 or 8 minutes at 72° with a small quantity of infusion of malt. As this, however, produces an additional amount of maltose, a check experiment must be carefully made, using the same amount of malt for the same volume of starch solution of approximately the same strength, and heating for exactly the same time at the same temperature. The further

action of the malt is stopped by plunging the flasks for a few minutes into boiling water.

L. DE K.

**Apparatus for Heating Substances in a Vacuum at Constant Temperatures.** WILLIAM R. HODGKINSON and ARTHUR H. COOTE (*Chem. News*, 1905, 91, 194).—An apparatus suitable for carrying out the "stability test" for gun-cotton and similar purposes is described and figured. The substance is held in a tube which is suspended in a heating vessel, and is suitably connected with an exhaust pump, and, if required, with a measuring tube in which the gases evolved may be collected.

D. A. L.

**Methods for Estimating Formaldehyde.** R. H. WILLIAMS (*J. Amer. Chem. Soc.*, 1905, 27, 596—601).—After having tried the standard methods, the author arrives at the following conclusions. Romijn's iodometric method (Abstr., 1897, ii, 166) is very accurate for pure dilute solutions of formaldehyde, whilst Romijn's cyanide process (*ibid.*, 167) may be recommended for dilute impure solutions; the results are lower than those obtained by the oxidation methods. Blank and Finkenbeiner's method (Abstr., 1899, ii, 188, 820), based on oxidising the formaldehyde with hydrogen peroxide in an alkaline solution and titrating the excess of alkali with litmus as indicator, is the most satisfactory for strong impure solutions. Legler's ammonia process (Abstr., 1883, 1035) is not so satisfactory, as the end-point in the titration is not defined very sharply. Paraformaldehyde, when present, counts as formaldehyde.

L. DE K.

**Colorimetric Method for the Detection and Estimation of Formaldehyde.** FREDERIC BONNET, jun. (*J. Amer. Chem. Soc.*, 1905, 27, 601—605).—Sixty c.c. of the liquid (milk, for instance) are placed in a 3-inch evaporating dish, and a 1-inch watch-glass containing 1 c.c. of morphine solution is allowed to float on it. The whole is then immediately covered with a 4 × 5-inch glass plate, and heated, preferably, at 25°.

The morphine solution is prepared by dissolving, just before use, 0.35 gram of pure morphine sulphate in 100 c.c. of chemically pure sulphuric acid. If formaldehyde should be present in the milk, the morphine becomes more or less coloured, and a ring is formed varying from pink to blue. By operating under exactly similar conditions with milks to which a known amount of formaldehyde has been added, and by noticing particularly the time required for the formation of the ring, a fair idea may be obtained as to the amount of formalin in any given sample. As a qualitative process, the method is also applicable to solid foods, such as butter.

L. DE K.

**Detection of Formaldehyde in Milk.** E. NICOLAS (*Compt. rend.*, 1905, 140, 1123—1124).—The author employs a modification of Manget and Marion's reaction (Abstr., 1903, ii, 115). The milk to be tested is curdled by the addition of a little acetic or lactic acid. After filtration, a quantity (an excess) of "amidol" is added to the filtrate, when, in a short time, the solution is coloured yellow or



orange and becomes strongly fluorescent should formaldehyde be present. In the absence of formaldehyde, the coloration rapidly becomes red, then brown, but without fluorescence. The test will detect 1 part of formaldehyde in 500,000.

W. P. S.

**The Vanillin-hydrochloric Acid Reaction.** LEOPOLD ROSENTHALER (*Zeit. anal. Chem.*, 1905, 44, 292—301).—Various ketones, such as acetone, diethyl ketone, dipropyl ketone, methyl ethyl ketone, methyl propyl ketone, methyl butyl ketone, pinacolone, acetylacetone, acetylacetone, benzylideneacetone, lævulose, and in general all aliphatic ketones yield characteristic colour reactions with the vanillin-hydrochloric acid reagent. It is merely necessary to expose filter paper wetted with the reagent to the vapour of the ketone. On the other hand, phenyl ethyl ketone, benzoylacetone, acetophenone, benzylideneacetophenone, benzophenone, tetramethyldiaminobenzophenone, benzoin, benzil, anthraquinone, and most of the aromatic ketones give a negative result. The reaction is in some cases extremely sensitive. If the reagent is mixed with an equal volume of concentrated sulphuric acid, one or two drops of a 0.01 per cent. solution of acetone will produce a violet colour on warming. Similar reactions are obtained with a large number of essential oils and some balsams, but with these it is necessary to shake the cooled mixture with ether to remove from the aqueous solution other colouring matters which would obscure the reaction. In some cases small amounts of adulterants can be detected by this means.

M. J. S.

**Phenolphthalin as Reagent for Hydrogen Cyanide.** F. WEEHUIZEN (*Chem. Centr.*, 1905, i, 1191; from *Pharm. Weekbl.*, 42, 271—272).—On addition of a solution of phenolphthalin rendered alkaline with sodium hydroxide and about 1/2000 of a copper sulphate solution to a solution containing hydrogen cyanide, the phenolphthalin is oxidised in the cold to phenolphthalein and the liquid turns red. One part of hydrogen cyanide in 500,000 parts of a liquid still gives the reaction.

L. DE K.

**Estimation of Cyanogen Iodide in presence of Iodine.** JAR. MILBAUER and R. HAC (*Zeit. anal. Chem.*, 1905, 44, 286—292).—It has been frequently stated that commercial iodine is liable to contain cyanogen iodide, but the methods of estimating that impurity have been very unsatisfactory. It can, however, be effected by Kjeldahl's process. The substance is triturated with concentrated sulphuric acid and transferred to the Kjeldahl flask with an equal volume of water. The mixture is cautiously heated to expel the free iodine with the aqueous vapour, and when this is complete the temperature is raised and the operation completed in the usual manner. Test experiments gave good results, but the impurity was not found in any of the specimens of commercial iodine examined.

M. J. S.

**Estimation of Oxalic Acid by Permanganate in presence of Hydrochloric Acid.** GREGORY P. BAXTER and JOAQUIN E. ZANETTI (*Amer. Chem. J.*, 1905, 33, [v], 500—506).—It is a well-known fact that a hydrochloric acid solution of an oxalate cannot be accurately titrated with permanganate unless a certain quantity of manganous sulphate is added. According to the author's investigation, this is due to the formation of hypochlorous acid. This may, however, be prevented by operating under well-defined conditions, when the results will be quite trustworthy.

The oxalic acid, which should amount to about 0.3 gram, is dissolved in 20 c.c. of hydrochloric acid of sp. gr. 1.04, diluted with water to 150 c.c. After heating to a little above 70°, a standardised solution of potassium permanganate (4 grams per litre) is run in very slowly and with constant stirring until the liquid turns pink. No oxalic acid is decomposed or volatilised, even at 90°. L. DE K.

**Improved Apparatus for Use in the Gottlieb-Röse Method of Estimating Fat in Milk.** ARMIN RÖHRIG (*Zeit. Nahr. Genussm.*, 1905, 9, 531—538).—To avoid pipetting off a portion of the ethereal layer obtained in this method, the milk is treated with ammonia, alcohol, ether, and light petroleum as usual in a stoppered, graduated cylinder provided with a side-tube and tap at about the 25 c.c. mark on the graduations. By means of this tap, an aliquot part of the ethereal solution may be drawn off into a weighed flask. The percentage of fat in butter may also be estimated by this method and apparatus. W. P. S.

**Rapid Method for the Analysis of Milk.** FRED. BORDAS and TOUPLAIN (*Compt. rend.*, 1905, 140, 1099—1100).—Ten c.c. of the milk are added drop by drop to a mixture of 65 per cent. alcohol and acetic acid contained in a weighed tube. After a few minutes, the tube and its contents are subjected to centrifugal action and the clear solution decanted. The residue is washed with 30 c.c. of 50 per cent. alcohol, separated, and decanted. The lactose in the united alcoholic solutions is then estimated according to Fehling's method. To dissolve the butter-fat from the residue remaining in the tube, the latter is twice treated with 2 c.c. of 96 per cent. alcohol and 30 c.c. of ether. Separation is effected each time in the centrifugal machine, and the ethereal solutions are evaporated in a tared flask. The casein remaining in the tube is then dried and weighed. An estimation of the ash on a separate 10 c.c. of the milk completes the analysis. In applying the method to sour milk, the total volume of the latter is noted, and the sample then separated by centrifugal action into two layers which are analysed separately. W. P. S.

**[Occurrence of Ammonia in Contaminated Milk.]** AUGUSTE TRILLAT and SAUTON (*Compt. rend.*, 1905, 140, 1266—1268).—It is shown that milk inoculated with urine or other animal matter almost always contains appreciable quantities of ammonia. The authors consider that, whilst the absence of ammonia is not a positive proof of the purity of the milk, its presence affords an assumption that the milk is contaminated with animal excreta. The method of detecting ammonia

in milk is a modification of the one previously described by Trillat (Abstr., 1905, ii, 282). Ten c.c. of the milk are treated with 10 c.c. of a 10 per cent. solution of iodine trichloride. The precipitate, consisting of the proteids and fat, is collected on a filter. To the filtrate is added, little by little, milk of lime until a dense black coloration, due to the formation of nitrogen iodide, is obtained.

W. P. S.

**Cachalot Oil.** GEORG FENDLER (*Chem. Zeit.*, 1905, 29, 555—556).—The author describes the examination of a sample of cachalot oil. It deposited crystals of spermaceti melting at 42°. Glycerol was detected in the oil, and an examination of the fatty acids was made.

A. McK.

**Influence of Atmospheric Oxidation on the Constants of Oils.** II. HENRY C. SHERMAN and M. J. FALK (*J. Amer. Chem. Soc.*, 1905, 27, 603—608. Compare Abstr., 1903, ii, 703).—The authors state that an oil with a low iodine number and specific refractive power, high sp. gr., index of refraction, and Maumené number may be considered to be partly oxidised by exposure or "blowing."

The original iodine number of a partly oxidised oil may be obtained with a fair degree of accuracy by adding to the iodine number found 0.8 for every 0.001 increase in the sp. gr. 15.5°/15.5°. This correction, however, only applies to non-drying and semi-drying oils.

If the original sp. gr. of the sample cannot be obtained, the calculation may be based on the average sp. gr. of the species under examination.

L. DE K.

**Stovaine.** F. ZERNIK (*Chem. Centr.*, 1905, i, 1028; from *Apoth. Zeit.*, 20, 174—175).—Stovaine, the hydrochloride of  $\alpha$ -dimethylamino-*tert*-amyl benzoate,  $\text{OBz} \cdot \text{CMeEt} \cdot \text{CH}_2 \cdot \text{NMe}_2 \cdot \text{HCl}$  (Fournau, Abstr., 1904, i, 377), gives precipitates with the ordinary alkaloidal reagents in a 1 per cent. solution. The following test is characteristic. When 0.05 gram of stovaine is evaporated with 1 c.c. of a mixture of equal parts of hydrochloric acid and nitric acid on the water-bath, a colourless compound which has a pungent odour is obtained. If 1 c.c. of a solution of potassium hydroxide in alcohol is added and the mixture evaporated, the residue has a fruity odour, and oily drops separate on addition of water. Stovaine may be used as a substitute for cocaine (compare Abstr., 1904, ii, 501).

E. W. W.

**New Reagent for Aconitine.** EUGENIO P. ALVAREZ (*Chem. News*, 1905, 91, 179—180).—When a minute quantity of aconitine is slightly heated with bromine in a porcelain crucible, evaporated to dryness with nitric acid, again treated with bromine, and evaporated to dryness with alcoholic potash, a red or brown residue is obtained, which becomes a deep green when treated with a 10 per cent. solution of copper sulphate.

D. A. L.

**Assay of Opium and its Preparations.** WALTER HENRY LENTON (*Pharm. J.*, 1905, 74, 652—653).—In the method described, the British Pharmacopœia process is followed up to the filtration of the



alkaline solution. Fifty c.c. of the latter are placed in a separating funnel, a plug of cotton-wool covered with a thin layer of disintegrated filter-paper or asbestos having been previously placed in the constriction above the tap. The requisite quantities of ether, alcohol, and ammonium chloride are added, the mixture is thoroughly shaken, care being taken not to dislodge the plug, and set aside for the specified time. The liquid is then forced through the plug by air-pressure applied by means of an ordinary bellows, and the residue washed twice with 20 c.c. of a mixture of equal volumes of ether and morphinated water. Finally, the contents of the funnel are washed with morphinated water until free from chlorides, and then quickly with 2 c.c. of water. Twenty-five c.c. of *N*/10 acid are now added to the funnel, the latter is shaken violently to dislodge the plug, and the excess of acid titrated back with *N*/20 sodium hydroxide, using methyl-orange as indicator.

W. P. S.

**Analysis of Tanning Materials.** JOHANNES PAESSLER (*Zeit. anal. Chem.*, 1905, 44, 301—304).—The author is not prepared to accept the opinion of Wislicenus (compare this vol., ii, 363) that exfoliated alumina should be substituted for hide-powder in the estimation of tannin. Its behaviour under varied conditions must first be thoroughly investigated and a consensus of opinion obtained with regard to the mode of preparing it and the uniformity of the results which it yields.

M. J. S.

**Mustard Seed.** C. HARTWICH and A. VIULLEMIN (*Chem. Centr.*, 1905, i, 1032—1033; from *Apoth. Zeit.*, 20, 162—164).—Myrosin is best detected by heating filtered aqueous extracts with a few drops of freshly prepared Millon's reagent. In the case of seeds of *Brassica nigra*, a reddish-brown precipitate is obtained, whilst with *Sinapis alba* the solution itself acquires an intense red colour. *Sinapis dissecta* and *S. arvensis* behave similarly to *S. alba*, so that an addition of *S. alba* and *S. arvensis* to black mustard is easily detected. In detecting myrosin microscopically in mustard seeds, the sections are washed with ether and chloroform, and treated successively with dilute acetic acid and cold concentrated hydrochloric acid (which produces a violet coloration) or with Millon's reagent. The ethereal oil is determined by Dieterich's method. The finely powdered seed (5 grams) is frequently agitated with water (100 c.c.) at 25—30°. Alcohol (20 c.c.) is then added and about half distilled off into ammonia (30 c.c.) and alcohol (20 c.c.), the first receiver being connected with a second, also containing ammonia and alcohol, to prevent loss. The contents of the receivers are united and heated on a water-bath with 3—4 c.c. of 10 per cent. silver nitrate and filtered. The silver sulphide is dried at 80° and weighed. The result, multiplied by 8.602, gives the percentage amount of ethereal oil. Seeds of *Brassica nigra* were found to contain from 0.825 to 1.191 per cent.

N. H. J. M.

## General and Physical Chemistry.

**Relation of Electrolytic Dissociation to Refractive Power: Non-electrolytes in Solution.** IVO ZOPPELLARI (*Gazzetta*, 1905, 35, i, 355—368).—Refractometric measurements of solutions of naphthalene, thymol, camphor, carbamide, and sucrose in benzene, methyl alcohol, acetone, and water show that the refractive powers vary with the concentrations of the solutions, the variations being of the same order as those shown by solutions of electrolytes. These variations depend either on a specific action of the solvent, which is, however, different for different substances, and may be related to the changes of volume occurring during solution, or on the inexactitude of the formulæ used to express refractive power, or on the fact that the law of mixtures is not rigorously applicable in all cases. Since the variations here observed are similar to those exhibited by electrolytes, the conclusions drawn with regard to the latter from the theory of electrolytic dissociation must be regarded as insecure. T. H. P.

**Photographs of Spark Spectra. III. Ultraviolet Spark Spectra of Platinum and Chromium.** WALTER E. ADENEY (*Sci. Proc. Roy. Dubl. Soc.*, 1904, 10, 235—249. Compare Abstr., 1902, ii, 57).—A full list is given of the wave-lengths of the lines observed. J. C. P.

**Absorption Spectra of Solutions of Chrome Alum.** EFISIO FERRERO and M. NOZARI (*Atti R. Accad. Sci. Torino*, 1904—1905, 40, 453—462. Compare Abstr., 1901, ii, 203).—The absorption spectrum of a solution of chrome alum exhibits increasing absorption from the red to the yellow, where it has a maximum value; the absorption then diminishes to the green, after which it increases again and becomes very great in the violet portion of the spectrum.

Like the internal friction (*loc. cit.*), the absorption spectrum of solutions of chrome alum shows a distinct change when the temperature is raised until the blue colour changes to green. The absorption spectrum of the blue solution presents a black band, the least deviated edge of which gradually fades away, whilst the end which is most deviated is sharp; the former edge approaches the red when the solution becomes green. The absorption curves for different temperatures show that the slope of the diminution of the absorption, which takes place as far as  $\lambda = 580$ , is very slight for temperatures below  $67^\circ$ , but at the latter temperature the slope becomes very distinct and remains the same at all higher temperatures. The maximum absorption for temperatures below  $67^\circ$  occurs at  $\lambda =$  about 489, whilst at or above  $67^\circ$  the maximum is at  $\lambda =$  about 497.

Curves and tables of the results are given.

T. H. P.

**Rotation of Optically Active Substances.** CHR. WINTHER (*Zeit. physikal. Chem.*, 1905, 52, 200—208. Compare Abstr., 1902, ii, 589; 1904, ii, 4).—A discussion, suggested by Walden's recent lecture

(this vol., ii, 130), of the most advantageous lines of future research on optical activity. The author insists on the necessity of determining rotation at different temperatures, and for light of different wavelengths, otherwise characteristic maxima remain undetected. As a measure of the rotation dispersion, the author advocates the use of dispersion coefficients in preference to that of specific and molecular rotation dispersion, and urges that whilst the five Landolt colours should be taken into account, yellow should be chosen as the standard to which the others are referred. The author argues against the form of temperature coefficient suggested by Walden, and considers that the variation of rotation with temperature should be represented by an equation of the type  $[\alpha]_t = a \pm bt \pm ct^2$ . Further, the bearing of time, variety of light, and temperature on the behaviour of each solvent should be investigated in detail. The value of this sort of work is seen to a certain extent in the "solution dispersion coefficients" previously determined (Winther, *loc. cit.*). J. C. P.

**Limits of Visibility of Fluorescence and the Higher Limit of the Absolute Weight of Atoms.** WALTHER SPRING (*Rec. Trav. chim.*, 1905, 24, 297—304. Compare de Bruyn and Wolff, *Abstr.*, 1904, ii, 470).—The fluorescence of a solution of fluorescein or of eosin in optically transparent water (*Abstr.*, 1899, ii, 537) becomes invisible in daylight when the amount of the fluorescent substance present falls to 0.000,000,01 gram per c.c., and is just visible at the apex of a powerful beam of electric light when the concentration is 0.000,000,000,000,001 gram per c.c. It is found that the area of liquid illuminated by the apex of the cone of light must be at least 1 sq. mm. in order to render the fluorescence visible, and consequently, assuming that 1 cubic millimetre of the liquid contains at least one molecule of fluorescein (mol. wt. 408) for example, then the weight of an atom of hydrogen would be  $2.5 \times 10^{-21}$  grams. This value, which represents only the higher limit among possible values, is much smaller than those arrived at from other considerations by Clerk Maxwell, Kelvin, de Heen, Annaheim, and others. T. A. H.

**Crystalloluminescence and Triboluminescence.** MAX TRAUTZ and P. SCHORIGIN (*Zeit. Elektrochem.*, 1905, 11, 306—307).—Many substances exhibit temporary triboluminescence consisting in bluish-white sparks produced in the crystals when they are broken. Among these are crystals of arsenic trioxide (from acid solution) and of sodium bromate. The following substances show feeble permanent triboluminescence in addition to the temporary phenomenon (which disappears in some days or weeks after the crystals are made): Barium chlorate, barium, strontium, calcium and magnesium bromates, potassium sodium sulphate ( $2K_2SO_4, Na_2SO_4$ ), and potassium sulphate crystallised from a solution containing potassium hydrogen sulphate and sodium fluoride.

Crystalloluminescence was observed with all substances possessing triboluminescence; it is probably the same phenomenon caused by impacts of the crystals on each other as they are formed in the solution. T. E.



**Sensitiveness of Photographic Action due to Hydrogen Peroxide.** J. PRECHT and C. OTSUKI (*Zeit. physikal. Chem.*, 1905, 52, 236—238. Compare this vol., ii, 296).—By means of its action on a photographic plate it is possible to detect hydrogen peroxide in the concentration  $3 \times 10^{-9}$  grams per c.c. of space. J. C. P.

**Some Properties of the  $\alpha$ -Rays from Radium.** ERNEST RUTHERFORD (*Phil. Mag.*, 1905, [vi], 10, 163—176).—The paper contains preliminary results of an attempt to determine the velocity and the ratio  $e/m$  of the  $\alpha$ -particle emitted from radium. It has been shown by Bragg and Kleeman (this vol., ii, 5) that four sets of  $\alpha$ -rays are emitted from radium, each capable of producing ionisation through a definite and different distance in air (that is, probably, each set is of a definite velocity), and that the ionisation power ceases abruptly at the limiting distance. The source of the  $\alpha$ -rays employed by the author was the deposit on the thin wire which had been negatively charged in the presence of radium bromide, and under the conditions of the experiment the rays examined would be almost entirely those from radium C. The deflection of the path by a strong magnetic field showed no widening of the cone of rays, so that all the particles were travelling with the same velocity. The value of  $mV/e$  obtained from the deflection was  $3.98 \times 10^5$ . The deflection by an electric field has not been determined, but on the assumption that the heating effect of radium C is entirely due to the  $\alpha$ -particles, the value for  $mV^2/e$  is obtained at  $1.03 \times 10^{16}$ . These lead to  $V = 2.6 \times 10^9$  cms. per second, and  $e/m = 6.5 \times 10^3$  electromagnetic units; a result in good accord with previous estimates. The effect of sheets of thin aluminium foil on the velocity was also investigated, and it was found that although a clear photographic impression was obtained after passage through 12 sheets (0.00031 cm. each), no effect was obtained after passage through 13 sheets, and the relative velocities after passing through various thicknesses are given, thus:  $V_0 = 1.00$ ; 5 sheets,  $0.85V_0$ ; 10 sheets,  $0.73V_0$ ; 12 sheets,  $0.64V_0$ . The energy after passage through 12 sheets is 0.41 of the original value, and the results indicate that the same proportion of the total energy is abstracted from the  $\alpha$ -particles in passing through successive layers. The abrupt falling-off of the photographic activity was found to correspond with the abrupt ceasing of the ionisation activity, and also with the phosphorescent action, and hence indicates that most probably photographic and phosphorescent effects are due to ionisation. The velocity of the  $\alpha$ -particles on emission is only about 30 per cent. more than that at which ionisation effects cease, and this leads the author to make the interesting suggestion that probably similar disintegration of matter and emission of particles is taking place in many other kinds of matter, but that the velocity of the particles is too small to produce those electrical or photographic effects by which this emission has been detected.

L. M. J.

**Secondary Radiation.** JOHN A. McCLELLAND (*Sci. Trans. Roy. Dubl. Soc.*, 1905, [ii], 8, 169—182).—When the  $\beta$  and  $\gamma$  rays of radium are allowed to penetrate a substance, the latter emits a

secondary radiation of negatively charged particles. Comparison of the deflections in a magnetic field shows that the primary and secondary  $\beta$ -rays are similar in character. As a general rule, the substances of greater density produce the greater secondary radiation, but there are many exceptions to this rule. If elementary substances alone are considered, it is found that the intensity of the secondary radiation increases in all cases with the atomic weight of the substance.

J. C. P.

**Secondary Radiation (Part II) and Atomic Structure.** JOHN A. McCLELLAND (*Sci. Trans. Roy. Dubl. Soc.*, 1905, [ii], 9, 1—8).—The atomic weight appears to be the chief factor in determining the intensity of the secondary radiation exhibited by elementary substances (see preceding abstract). This point has been further tested, and the foregoing result confirmed for a large number of elements. It is further found that the secondary radiation increases less rapidly than the atomic weight. When the intensity of secondary radiation is plotted against atomic weight, a curve is obtained which shows the elements falling into well-marked divisions corresponding with Mendeléeff's periods. The curve flattens at the end of each period, and there is little increase of secondary radiation in passing from one period to the next. The view is adopted that the manner in which additional electrons are added on to form elements of greater atomic weight is different in passing from one period to the next from what it is in passing through elements not near the ends of a period.

J. C. P.

**Properties of Radium in Minute Quantities.** W. A. DOUGLAS RUDGE (*Phil. Mag.*, 1905, [vi], 10, 183).—A thin film produced on glass by the evaporation of a small quantity of solution of a radium preparation, in December 1903, is still as active as a week after preparation, although the quantity of radium present could not have been more than 0.000005 mg. (See Eve, this vol., ii, 367.)

L. M. J.

**Simple Recognition of Helium from Radium Bromide.** FRIEDRICH GIESEL (*Ber.*, 1905, 38, 2299—2300. Compare Abstr., 1903, ii, 20).—Two Geissler tubes of 5 and 15 c.c. capacity respectively, with aluminium electrodes, were charged each with 50 mg. of anhydrous radium bromide and evacuated as completely as possible, when the hydrogen and mercury lines were still prominent in the smaller but only faint in the larger tube. After two months the smaller tube exhibited the helium line  $D_3 = \lambda 587.6$ , and after six months the lines  $\lambda 502$ ,  $\lambda 495$ ,  $\lambda 470$ , and  $\lambda 446$ , the last three only faintly. So far the larger tube has exhibited only the line  $D_3$ .

The helium spectrum was not diminished by prolonged passage of the induction current, and no alteration of the pressure in the tubes, as judged from the illumination, could be observed. As the activity of the gases in the tubes is much less than that of the gases obtained from radium solutions, the emanation must be retained by the anhydrous radium bromide.

G. Y.

**Actinium and Emanium.** WILLY MARCKWALD (*Ber.*, 1905, 38, 2264—2266. Compare Debierne, *Abstr.*, 1904, ii, 223, 729; Giesel, *Abstr.*, 1904, ii, 462, 800; Hahn and Sackur, this vol., ii, 432).—The thorium (0.7 gram) precipitated from the chlorides of the noble earths (40 grams), obtained from the radium mother liquors, was strongly radioactive, the emanation exhibiting the rapid decay characteristic of actinium. The radioactive substance was not separated from the thorium on purification of this by solution in hydrochloric acid, precipitation as the oxalate, and conversion by heat into the oxide, but after some months the emanation ceases, the actinium losing its radioactivity. The cerium oxide and the mixture of didymium and lanthanum oxides obtained from the filtrate from the thorium are only slightly radioactive; the cerium oxide remains so, but the radioactivity of the didymium lanthanum oxide mixture increases as that of the thorium decreases. On dissolving the didymium lanthanum oxide mixture (18 grams) with 0.5 gram of inactive thorium oxide in hydrochloric acid and precipitating the thorium with sodium thiosulphate, the precipitate contains actinium whilst the didymium lanthanum oxides regained from the solution are only slightly radioactive.

Emanium and actinium are therefore not identical, but are genetically related: lanthanum  $\rightarrow$  emanium  $\rightarrow$  actinium. The names emanium and actinium would be more suitable if reversed, as it is the latter substance which yields an emanation. The author protests against the naming of such substances before they are thoroughly investigated.

G. Y.

**Actinium and its Successive Products.** T. GODLEWSKI (*Bull. Acad. Sci. Cracow*, 1905, 265—276; *Phil. Mag.*, 1905, [vi], 10, 35—45).—Actinium behaves very similarly to thorium in its radioactive properties, producing an emanation which is transformed into an active deposit; this undergoes (1) a slow, rayless change, and (2) a rapid change. The author has applied to these actinium products the methods employed by Rutherford and Soddy in the case of the thorium products. The actinium compound was dissolved in hydrochloric acid and precipitated by ammonia: the precipitate was almost inactive; the residue from the filtrate was intensely active, but the activity decreased according to the exponential law, whilst the recovery curve for the precipitate was almost complementary. The active substance, termed AcX, does not immediately decrease, however, but first increases slightly, then afterwards falling to the half value in 10.2 days, this resembling ThX. It was found that AcX gave out  $\alpha$ -,  $\beta$ -, and  $\gamma$ -rays, and the author considers that the  $\beta$ -rays are in this case due to the actinium X itself and not solely to incited activity; in this respect it would differ from thorium X. The actinium X gives rise to an emanation with an exceptionally rapid rate of decay. This, as in the case of thorium, gives rise to three products, AcA, AcB, and AcC. The  $\beta$ -rays emitted by actinium are remarkable in being perfectly homogeneous and have less than half the penetrating power of those emitted by any other radio-element (compare *Abstr.*, 1904, ii, 223, 799).

L. M. J.



**Radioactivity of the Bohemian Mineral Springs:** Karlsbad, Marienbad, Teplitz-Schönau-Dux, and Franzensbad, and of St. Joachimsthal. HEINRICH MACHE and STEFAN MEYER (*Monatsh.*, 1905, 26, 595—625. Compare Mache, this vol., ii, 367).—The radioactive emanation obtained from the gases and waters of the springs in Karlsbad, Marienbad, Teplitz-Schönau-Dux, Franzensbad, and St. Joachimsthal is found to vary in amount between different springs in the same locality. Its rate of decay, as also that of the induced radioactivity, is the same as the rate of decay of radium emanation and of the activity induced by radium emanation. The presence of thorium could not be detected.

In Karlsbad, the cold ferruginous spring situated within the thermal sphere contains a greater proportion of radium emanation than the thermal springs, amongst which the radioactivity decreases with increasing temperature. In Teplitz-Schönau and in Franzensbad, the variation in amounts of emanation in the different springs is connected probably with the geological formation.

The waters from the St. Joachimsthal mines are highly radioactive, the amount of emanation increasing with the depth at which the spring is found. The lowest spring contains a larger proportion of radioactive emanation than has been found in any water previously examined.

In the springs evolving small amounts of gas, the ratio: *emanation in water, emanation in gas*: falls with the rise of temperature. As this ratio is much greater in the springs which give off large amounts of gas, the emanation in the gas must be derived from the water, an equilibrium being reached only in the former class of springs. G. Y.

**"Thorium Activity" of Monazite.** FRIEDRICH GIESEL (*Ber.*, 1905, 38, 2334—2336. Compare Sackur, this vol., ii, 367).—The "thorium activity" of monazite is not to be ascribed to the presence of thorium itself. The author has proved this by an examination of the radioactivity of the rare earths from monazite sand, when fractions which contained practically no thorium were found to be strongly radioactive. A. McK.

**Some Radioactive Properties of Uranium.** T. GODLEWSKI (*Phil. Mag.*, 1905, [vi], 10, 45—60).—It was shown by Rutherford (Abstr., 1904, ii, 347), that if uranium is deprived of uranium X, the curves for increase of activity of the former and decay of activity of the latter are complementary, the half-value being reached in about 22 days. Meyer and Schweidler have found, however, that if uranium nitrate solution is shaken with ether, the ethereal solution contains no UrX, and the  $\beta$ -activity of this increases to half the total value in 22 days, but the crystals of uranium nitrate obtained from the aqueous solution lost  $\beta$ -activity at a different rate, decaying to half-value in 2 days. The cause of this behaviour has been investigated by the author, who shows it to be due to the fact that the UrX tends to remain in the mother liquor, and not to separate out with the crystals of the nitrate. One consequence of this is, that when any large crystals separate out from below in a solution, the upper surface of the crystal

is richer in  $\text{UrX}$  than the lower and exhibits a higher activity, but that the upper and lower activities tend to a constant value indicating a diffusion of the  $\text{UrX}$  through the crystals, even when the latter seem to be completely dry.

L. M. J.

**Galvanic Cells produced by the Action of Light.** MEYER WILDERMAN (*Proc. Roy. Soc.*, 1905, '74, 369—378. Compare Abstr., 1902, ii, 545).—A preliminary communication, dealing largely with the physico-mathematical theory of light cells, that is, cells in which one electrode is in the dark whilst the other is illuminated. The author has succeeded in elucidating the reactions and chemical equilibrium in light cells, including the phenomena of induction and deduction. It has been found that the total  $E.M.F.$  in a light cell is due partly to increase of chemical potential and of solution pressure of the exposed electrode, and partly to a thermo- $E.M.F.$  caused by the one electrode being heated by the light. Both these  $E.M.F.s$  are directly proportional to the intensity of the light and both give currents in the same direction. Hence it appears that light acts on the chemical potential and the solution pressure of the electrode in the same way as heat does.

J. C. P.

**Ionic Velocities.** S. TIJMSTRA (*Zeit. Elektrochem.*, 1905, 11, 249; HEINRICH DANNEEL, *ibid.*, 249—252).—Dempwolff (this vol., ii, 9) has found that the methoxyl ion in methyl alcohol has a velocity equal to that of the halogen ions. Tijmstra (Abstr., 1904, ii, 699) has shown that its velocity is greater than that of the hydroxyl ion. Danneel considers that the increase of the velocity of an ion in presence of undissociated molecules containing it is merely apparent. When an anion, for example, collides with the cation side of its parent molecule, it is supposed to remain combined, the displaced anion carrying on the electric charge. In this way the path which the ion has to traverse is shortened, and the transport of electricity apparently accelerated. It is shown that the apparent increase of the mobility of the ions of sodium and potassium chloride (Jahn, this vol., ii, 145) are possibly capable of explanation in this way.

T. E.

**Dissociation of Electrolytes.** CARL LIEBENOFF (*Zeit. Elektrochem.*, 1905, 11, 301—306).—An equation connecting the concentrations of the dissociated and non-dissociated parts of an electrolyte is deduced, partly from theoretical considerations which cannot be briefly abstracted. By means of it, the conductivity of dilute solutions of some salts are calculated with considerable accuracy.

T. E.

**Electroaffinity of Anions. I. The Oxalate Ion.** HANS SCHÄFER (*Zeit. anorg. Chem.*, 1905, 45, 293—323).—According to Abegg and Bodländer's method, the electroaffinity of the oxalate anion is ascertained from a study of the formation of double oxalates and from measurements of the ionic concentrations of the oxalates. The oxalate anion has a small electroaffinity as shown by the formation of numerous stable double oxalates and confirmed by the difficult solubility of most of the oxalates of the heavy metals. The paper contains

the following sections: (1) a review of the solubilities of oxalates and an account of the known double oxalates; (2) the double oxalates of copper; (3) the solubility of silver oxalate; its equilibrium with silver chromate; the dissociation of oxalic acid and its salts; (4) iron oxalates.

D. H. J.

**Connection between Electrolytic Changes and the Temperature of the Electrodes.** WILHELM MOLDENHAUER (*Zeit. Elektrochem.*, 1905, 11, 307—330).—The quantity of heat developed at an electrode is, according to Ostwald, the sum of the quantity of heat liberated by the chemical change at the electrode and the quantity of heat due to the passage of the electricity from the potential of the electrode to that of the electrolyte. These quantities are calculated for a number of typical cases from existing data. Experiments are then described in which the temperature of a tubular electrode is measured and also the temperature of the electrolyte, which is cooled by circulation of water in a coil. When the conditions of the experiment are kept constant, the difference of temperature between the electrode and the electrolyte is nearly proportional to the quantity of heat developed at the electrode. With sulphuric acid, the quantity of heat developed at the anode diminishes as the temperature of the electrode rises; at the same electrode temperature, it is nearly proportional to the current; it is least for acids containing from 2.4 to 9 per cent. of sulphuric acid. Less heat is developed with a platinised than with a smooth anode owing to the smaller potential difference. With strong acid the development of heat is sometimes very large for a short time owing to the formation of a layer of very concentrated acid of high resistance at the surface of the electrode. The observations are in qualitative agreement with the theory. At the cathode, a small absorption of heat is to be expected, and with platinised electrodes this was observed. Similar experiments are described with solutions of phosphoric and hydrochloric acids, potassium hydroxide, ammonium sulphate, and potassium chloride. With the latter, regular periodic variations in the heat developed at the anode were observed which are explained by changes in the nature of the electrolyte in contact with it, and corresponding changes in the chemical process going on there.

Further experiments deal with the influence of the anode temperature on the nature of the products formed. A hollow, suitably cooled platinum anode was used.

With sulphuric acid of sp. gr.  $\leq 1.45$ , the yield of persulphuric acid is improved by cooling the anode to  $-2^{\circ}$ , whilst with more concentrated acids it is diminished; these results seem to depend on the concentration of the  $\text{HSO}_4$  ions present. In the preparation of ammonium persulphate or of potassium percarbonate, a small improvement in yield is obtained by cooling the anode to  $-2^{\circ}$ . When a solution containing 20 per cent. of potassium chloride and 1 per cent. of potassium hydroxide is used, the yield of hypochlorite increases to a maximum as the anode temperature rises from  $0$  to  $15^{\circ}$ , falling off at higher temperatures, whilst the quantity of chlorate simultaneously formed increases steadily.

T. E.



**Chemical Transfer of Metallic Potentials and the Chemical Solution Pressure of Metals.** FRANZ FISCHER (*Zeit. physikal. Chem.*, 1905, 52, 55—88).—When external influences are excluded, the *E.M.F.* of certain open cells of the type metal | metallic salt solution | Pt slowly falls to zero, the same change taking place in a few hours if the contents of the cell are shaken. The metals for which this change has been observed are copper, mercury, and silver. Metals, on the other hand, such as zinc, at the other end of the electromotive scale, behave differently; the *E.M.F.* of a cell of the foregoing type falls off in this case until it assumes the value for the cell metal | metallic salt solution | hydrogen. Special examination of the cell Cu | copper sulphate | Pt shows that the change takes place at the platinum electrode only, and the view is adopted that cuprous sulphate is formed from the metallic copper and the copper sulphate, this in turn involving a tendency throughout the electrolyte to the separation of copper. The copper potential is thus transferred to the platinum electrode. The part played by the cuprous sulphate is illustrated by the fact that by the use of various solutions all saturated with cuprous sulphate the platinum can be made to assume any potential between that of oxygen and that of copper. That the *E.M.F.* of the cell Cu | copper sulphate | Pt falls off gradually is attributed to the formation of alloys of the two metals, these alloys becoming gradually richer in copper as the distribution of the cuprous sulphate through the electrolyte proceeds.

The observations recorded in the paper are connected with what is called the "chemical solution pressure" of the metals; by this term is meant, in contrast to "electrolytic solution pressure," a solution pressure in virtue of which a metal dissolves but without an accompanying electrical charge. A case in point is the reaction  $\text{Cu} + \text{Cu}^{++} = 2\text{Cu}^+$ .

J. C. P.

**Electromotive Behaviour of Copper and Zinc in their Solutions in Alkali Cyanides.** FRITZ SPITZER (*Zeit. Elektrochem.*, 1905, 11, 345—368).—The differences of potential between copper and solutions of cuprous potassium cyanide,  $\text{KCu}(\text{CN})_2$ , containing various quantities of potassium cyanide and between zinc and solutions of zinc potassium cyanide,  $\text{K}_2\text{Zn}(\text{CN})_4$ , and potassium cyanide are measured. Considerable difficulty is experienced in obtaining constant values, especially in the case of copper. The solutions are all positive to the metals. Increase of the concentration of the copper or zinc salt or increase of the excess of potassium cyanide increases the potential difference, or, in other words, decreases the concentration of the metallic ions in the solution. Comparing solutions containing the same quantity of potassium cyanide, it is seen that the *P.D.* between zinc and a zinc solution is greater than that between copper and a copper solution, but the difference becomes smaller as the concentration of the cyanide increases; the influence of the concentration of the copper or zinc also diminishes so that in solutions containing about 2.5 gram mols. of potassium cyanide per litre, zinc and copper have about the same potential. In more concentrated cyanide solutions, copper has the higher potential.

Copper precipitates zinc from a solution of zinc potassium cyanide containing any excess of potassium cyanide, whilst zinc precipitates copper from solutions of potassium cuprous cyanide containing less than about 5 mols. of potassium cyanide solution per litre. The explanation of this apparently anomalous behaviour is that when zinc is precipitated by copper it combines with the copper, the compound having a very much smaller solution pressure than pure zinc.

This is proved by a number of experiments on the electrolysis of solutions of copper and zinc, cyanides dissolved in potassium cyanide solution. From such solutions, brass (with about 30 per cent. of zinc) is deposited at cathode potentials much below the potential of zinc in the solution.

The deposition of both copper and zinc from these solutions takes place with difficulty, so that when the current density is increased the potential of the cathode increases quickly and the value required for the liberation of hydrogen is soon reached. For this reason, no metal is deposited from solutions containing a large excess of potassium cyanide.

The numerical results of the experiments are given in the form of tables.  
T. E.

**Dissociation of Ternary Electrolytes.** GOTTFRIED KÜMMELL (*Zeit. Elektrochem.*, 1905, 11, 341—343. Compare this vol., ii, 226).—Replying to the criticisms of Drucker (this vol., ii, 371), the author shows that the depression of freezing point produced by a mixture of magnesium and potassium chlorides is almost equal to the sum of the depressions of the separate salts. Hence it is probable that complex ions are not formed from these salts. The *E.M.F.s* of cells consisting of two calomel electrodes, one with potassium or sodium chloride, the other with magnesium chloride solution, are shown to be 0.004 and 0.002 volt respectively when the solutions are isohydric. This confirms the view that the concentrations of the chlorine ions in these isohydric solutions are the same, the small *E.M.F.s* observed being due to the different mobilities of the  $\text{Na}^+$  or  $\text{K}^+$  ions and the  $\text{MgCl}^-$  ions.

Drucker's method, based on the depression of freezing point, is only exact when applied to very dilute solutions. It has also the disadvantage of giving the ionic concentrations only at the freezing point, and is therefore unsuitable for electrolytes the dissociation of which is much affected by temperature.  
T. E.

**Hall Effect of Bismuth at High Temperatures.** HEINRICH FRHR. RAUSCH VON TRAUBENBERG (*Ann. Physik*, 1905, 17, 78—103).—The Hall effect was investigated with three plates of bismuth, and the variation with temperature determined from ordinary temperatures to the melting point. The Hall rotation coefficient was found to decrease with temperature, the value falling at first rapidly but at a decreasing rate until about  $260^\circ$ , after which the fall is rapid to the melting point.  
L. M. J.

**Influence of Concentration on the Magnetic Properties of Solutions of Cobalt.** P. VAILLANT (*Compt. rend.*, 1905, 140, 1632—1634).—Measurements were made with solutions of the chloride, sulphate and nitrate of cobalt, using Becquerel's torsion method of observation. The results show that the specific coefficient ( $k$ ) varies little with the nature and concentration of the acid group, and that it diminishes as the concentration of the salt in the solution increases. This variation in the value of  $k$  appears to be due to ionisation. The values of  $c$  and  $c'$ , the specific coefficients of dissociated and undissociated molecules of the salt respectively, are discordant in the cases of solutions of the sulphate and the chloride. These irregularities are probably due to the formation of different hydrates (compare Abstr., 1903, ii, 254), since the values become more concordant as the solutions become more dilute and, *pari passu*, the hydration becomes stationary.

T. A. H.

**Physical Properties of an Extensive Series of Alloys of Iron.** IV. Thermal Conductivity. V. Micro-structure. W. FLETCHER BARRETT, W. BROWN, and ROBERT A. HADFIELD (*Sci. Trans. Roy. Dubl. Soc.*, 1904, [ii], 8, 109—126. Compare Barrett, Abstr., 1902, ii, 377).—Uniform rods made of the alloys were covered with a thin coating of paraffin wax; the length of wax melted in each case, after one end of the rod had been kept for a long time at a high, steady temperature, was measured. The thermal conductivities of any two rods are then proportional to the squares of the lengths of wax melted in each case. The results obtained in this way were confirmed generally by another and more accurate method in which the temperature gradient in each rod was determined by means of thermocouples lashed on to the rod.

The thermal conductivity (as also the electrical conductivity) of iron is lowered by carbon and manganese, the drop being most marked for the first small additions. Nickel also lowers the thermal and electrical conductivities of iron, but to a much smaller extent than the same percentage of carbon or manganese. So far, tungsten has the least effect of any single element in reducing the thermal conductivity of iron; aluminium has the greatest effect. The highest thermal and electrical resistivity has been found in the case of an alloy containing 69.36 per cent. of iron, 25 per cent. of nickel, and 5.04 per cent. of manganese. It is noteworthy that of a series of steel alloys containing copper, none had a higher thermal or electrical conductivity than the iron taken as standard. These alloys, however, contained impurity in the shape of carbon or manganese, both of which tend to lower the conductivity. At the same time, it is considered probable that copper would have very little effect on the conductivity of pure iron. Thermal conductivity, like electrical conductivity, is increased by annealing.

Compared with copper, the electrical conductivity of iron and its alloys is throughout lower than their thermal conductivity. When the conductivity is plotted against the percentage of the added element, the general trend of the curves for any one series of alloys is the same thermally and electrically. The curve obtained by taking



thermal conductivities as ordinates and electrical conductivities as abscissæ is fairly smooth and of parabolic form, except when the conductivities are very low, in which case the curve becomes much steeper.

It has been shown previously by the authors that a small percentage of silicon or aluminium alloyed with iron raises the magnetic permeability beyond that of the purest commercial iron, whilst a sufficient addition of manganese, itself feebly magnetic, renders iron practically non-magnetic. It was suggested that silicon or aluminium, combining with oxygen or dissociated gas, may free the iron from oxide or give it a closer texture, and thus raise its magnetic permeability. A study of the microstructure of some alloys has accordingly been made at the National Physical Laboratory, and the results of this study are in harmony with the foregoing suggestion. J. C. P.

**Calorimetric Methods, especially referring to the Determination of the Heat of Combustion of Organic Compounds.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 140, 1497—1504).—An historical *résumé* of the work done by the author and others on heats of combustion; polemical in reply to Thomsen (compare this vol., ii, 231 and 435). M. A. W.

**Determination of Specific Heats of Solutions. Molecular Heats of Good and Bad Electrolytes.** PAUL TH. MULLER and C. FUCHS (*Compt. rend.*, 1905, 140, 1639—1641).—A constant electric current is passed for a definite length of time through a hollow glass spiral filled with mercury and wholly immersed in the solution the specific heat of which is to be measured. The resultant change of temperature of the solution is observed, and from this and the usual data its specific heat ( $c$ ) is calculated. The molecular heat of the solution is equal to  $(M + 18n)c$ , where  $M$  is the molecular weight of the salt,  $n$  the number of molecules of water in which  $M$  is dissolved, and  $c$  the specific heat of the solution.

The molecular heat of the solution diminishes as the concentration of the solute decreases, and may even become negative in the case of good electrolytes, but with poor electrolytes change of concentration produces little or no variation in the value of this constant. This difference is explained by the assumption that the variation in the value of the molecular heat is due to change in the state of hydration, and that ionised substances exhibit a greater facility for undergoing hydration than un-ionised substances (compare Berthelot, *Mécanique chimique*, 1879, i, 508; Puschl, *Abstr.*, 1901, ii, 224; and Jones and Getman, *Abstr.*, 1904, ii, 386). T. A. H.

**Mercury Formates.** RAOUL VARET (*Compt. rend.*, 1905, 140, 1641—1643).—By observing the heat changes involved in reactions between mercurous formate and potassium iodide alone and in presence of iodine, the value 175.1 Cal. was obtained for the heat of formation of solid mercurous formate. The heat of formation of solid mercuric formate was found to be 161.5 Cal. by means of measurements of the heat developed by the solution of mercuric oxide in

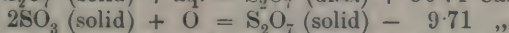
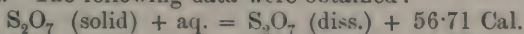
formic acid. The decomposition of mercuric formate into mercurous formate, formic acid, and carbon dioxide develops 53.2 Cal.; and into liquid mercury, liquid formic acid, and carbon dioxide, 20.7 Cal. The solution of mercuric formate in formic acid develops 1.8 Cal.

T. A. H.

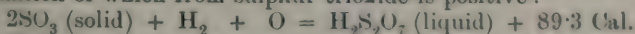
**Thermochemistry of Neodymium.** CAMILLE MATIGNON (*Compt. rend.*, 1905, 141, 53—55).—The heat of formation of the reddish-brown form of neodymium sulphide,  $\text{Nd}_2\text{S}_3$ , is 285.9 Cal., that of the anhydrous chloride 249.5 Cal., of the hydrated chloride,  $\text{NdCl}_3 \cdot 6\text{H}_2\text{O}$ , 268.9 Cal., of the anhydrous iodide 157.7 Cal., of the anhydrous sulphate 928.2 Cal., and of the hydrated salt,  $\text{Nd}_2\text{O}_3 \cdot 3\text{SO}_3 \cdot 8\text{H}_2\text{O}$ , 946.8 Cal. These values indicate that neodymium and the related elements, so far as chemical affinity is concerned, occupy a place between the alkali metals and magnesium.

T. A. H.

**Combustion of Sulphur in the Calorimetric Bomb.** H. GIRAN (*Compt. rend.*, 1905, 140, 1704—1707).—The fact that the heat developed by the combustion of sulphur in the calorimetric bomb increases with the pressure has been previously supposed by the author to be due to the formation of increasing quantities of persulphuric anhydride (compare this vol., ii, 76). This hypothesis is now shown to be untenable, for, according to calorimetric measurements, heat is absorbed when persulphuric anhydride is formed from sulphur trioxide and oxygen. The following data were obtained:



After the combustion of sulphur in the bomb, a viscous liquid of light-brown colour remained which evolved nitrous fumes on contact with water. This was found to be pyrosulphuric acid containing acid nitroxyl sulphate in solution, the formation of which was due to the presence of nitrogen in the oxygen used in the experiments. When the liquid was heated, it evolved sulphur trioxide, and the acid nitroxyl sulphate separated in crystalline form. It is calculated that the small proportion of hydrogen present in the oxygen used was sufficient to convert all the sulphur trioxide formed into pyrosulphuric acid, the heat of formation of which from sulphur trioxide is positive:



These exothermic changes are now regarded as the cause of the increase of the heat of combustion of sulphur with increasing pressure.

H. M. D.

**Heats of Solution and of Dilution.** RUDOLF WEGSCHEIDER (*Monatsh.*, 1905, 26, 647—662. Compare Stackelberg, *Abstr.*, 1898, ii, 498).—Equations are given for the relationships between the various heats of solution and of dilution, which permit of these being calculated from the total heat of solution; this being represented as a function of the volume of water, and to be derived from the heat of dissolution in a solution with the aid of the heat of dilution. The method of calculation and the accuracy obtainable, especially for the

infinitesimal heat of solution, are exemplified in the case of sodium carbonate and nitrate and potassium chlorate. G. Y.

**Apparatus for the Determination of the Specific Gravity of Solid Substances in Powder or in a Granular Form.** J. von WROCHEM (*Chem. Centr.*, 1905, i, 1577—1578; from *Mitt. Techn. Vers.-A. Berlin*, 22, 217—220).—The original paper contains a critical account of the apparatus of Schumann, Suchier, Beck and Erdmenger, and Mann, with reference to their use for cement. A modification of the last-named apparatus is sketched and described in the abstract.

The measuring tube is connected with a flask by means of an india-rubber bung with two holes. The lower portion of the tube passes through one hole and reaches to the bottom of the vessel. In the second hole a T piece is fitted, one limb of which is attached to a rubber pressure ball, whilst by means of the other the apparatus may be filled or any excess of pressure relieved. A glass tap in the lower portion of the measuring tube just above the bung of the flask serves to connect or separate the two vessels, and between this and the cooling jacket which surrounds the measuring tube a side tube with a tap is attached through which the measuring flask is filled. In a newer form, an automatic adjusting arrangement similar to that of a Zahn burette is attached in place of the side tube. The measuring tube has a capacity of 50 c.c. and is graduated below the bulb from 0 to 15 c.c. in 1/20 c.c. The whole apparatus is mounted on suitable stands. E. W. W.

**Densities of Carbon Dioxide, Ammonia, and Nitrous Oxide.** PHILIPPE A. GUYE and ALEXANDRE PINTZA (*Compt. rend.*, 1905, 141, 51—53. Compare Abstr., 1904, ii, 812).—The carbon dioxide was prepared by heating sodium hydrogen carbonate. It was weighed by absorption in a strong solution of potassium hydroxide. The ammonia was obtained from commercial liquid ammonia and was freed from amines by passing it over red-hot lime and then converting it into the chloride, recrystallising this and regenerating the ammonia, which was dried over potassium hydroxide contained in soda-glass vessels. It was weighed by absorption in charcoal.

The mass of 1 litre of carbon dioxide was found to be 1.9768 grams, of ammonia 0.7708 gram, and of nitrous oxide 1.9774 grams. These values for carbon dioxide and nitrous oxide agree within the limits of experimental error with those found by Rayleigh, but the value found for ammonia is considerably lower than that (0.7719) observed by Leduc. Comparison of the values found for nitrous oxide and carbon dioxide by the method recently described (this vol., ii, 442) leads to the figure 14.007 for the atomic weight of nitrogen, and the application of the same method to those found for nitrogen and carbon monoxide to the value 14.006 for this constant. T. A. H.

**Expansion and Density of some Gases at High Temperatures: Application to the Determination of their Molecular Weights.** ADRIEN JAQUEROD and F. LOUIS PERROT (*Compt. rend.*, 1905, 140, 1542—1544).—Using a nitrogen thermometer (compare



this vol., ii, 10), the authors have measured the coefficient of expansion between  $0^{\circ}$  and  $1067^{\circ}$  of some of the common gases, and the results are appended :

Gas.	Initial pressure at $0^{\circ}$ .	Coefficient of expansion at constant volume between $0^{\circ}$ and $1067^{\circ}$ .
Air.....	230 mm.	0.003,6643
Oxygen .....	180—230 „	0.003,6652
Carbon monoxide...	230 „	0.003,6648
Carbon dioxide .....	{ 240 „	0.003,6756
	{ 170 „	0.003,6713

The corresponding value for nitrogen, calculated from the experimental value between  $0^{\circ}$  and  $100^{\circ}$  (0.003,6650), is the same as that of air. The molecular weights of the gases at  $1067^{\circ}$ , calculated from their densities at that temperature, are—nitrogen 28.0155, carbon monoxide 28.009, and carbon dioxide 43.992 ( $O_2 = 32$ ). M. A. W.

**Osmotic Experiments on Mixtures of Alcohol and Water.** P. S. BARLOW (*Phil. Mag.*, 1905, [vi], 10, 1—12).—Pickering has described an experiment which he considered a conclusive proof of the existence of hydrates in solution. A mixture of propyl alcohol and water is separated from water by a semi-permeable membrane and exhibits an increase of osmotic pressure, but a similar increase is obtained if the cell containing the mixture is placed in propyl alcohol. The contention of Pickering, therefore, was that the membrane is permeable to either the alcohol or water, but not to the complex hydrated molecules. The author has repeated the experiment with methyl, ethyl, and propyl alcohols, and finds, as stated, that an increase of osmotic pressure results, but that this is only temporary, and that after a maximum value has been obtained the pressure falls steadily and permanently. His experiments indicate that this fall is due to the liquid present in the walls of the porous pot which does not become displaced and does not reach a new equilibrium until a short time after being placed in a new liquid. L. M. J.

**Different Forms and Transformations of the Boundary Curves in the case of Partial Miscibility of Two Liquids.** JOHANNES J. VAN LAAR (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 7, 636—646).—A continuation of the earlier paper (this vol., ii, 234). J. C. P.

**Exact Expression for the Course of the Spinodal Curves and of their Plait Points for all Temperatures, in the case of Mixtures of Normal Substances.** JOHANNES J. VAN LAAR (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 7, 646—657).—A theoretical paper. J. C. P.

**Shape of the Plait-point Curve for Mixtures of Normal Substances.** JOHANNES J. VAN LAAR (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 33—48).—A continuation of the earlier communication (preceding abstract). J. C. P.

**Phase Rule.** RUDOLF WEGSCHEIDER (*Zeit. physikal. Chem.*, 1905, 52, 171—184. Compare Abstr., 1903, ii, 356; 1904, ii, 112, 389).—A theoretical paper.

J. C. P.

**Some Determinations in the Systems:**  $\text{KIO}_3\text{—HIO}_3\text{—H}_2\text{O}$ ,  $\text{NaIO}_3\text{—HIO}_3\text{—H}_2\text{O}$ , and  $\text{NH}_4\text{IO}_3\text{—HIO}_3\text{—H}_2\text{O}$ . PIETER A. MEERBURG (*Zeit. anorg. Chem.*, 1905, 45, 324—344).—In order to determine the exact conditions under which potassium di-iodate is formed at a definite temperature from aqueous solutions of its components  $\text{KIO}_3$  and  $\text{HIO}_3$ , the ternary system  $\text{KIO}_3\text{—HIO}_3\text{—H}_2\text{O}$  has been investigated at  $30^\circ$ , and for comparison the isotherms for the same temperature in the case of the systems  $\text{NaIO}_3\text{—HIO}_3\text{—H}_2\text{O}$  and  $\text{NH}_4\text{IO}_3\text{—HIO}_3\text{—H}_2\text{O}$  have been determined; the "residue method" of the previous communication (Abstr., 1904, ii, 112) was employed.

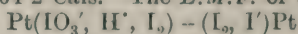
For the system  $\text{KIO}_3\text{—HIO}_3\text{—H}_2\text{O}$ , the original paper gives the exact conditions for the formation of the known binary compounds,  $\text{KIO}_3\text{,HIO}_3$  (di-iodate) and  $\text{KIO}_3\text{,2HIO}_3$  (tri-iodate), from their components. It is possible to crystallise potassium di-iodate from pure water at  $30^\circ$ ; hence, when the tri-iodate is crystallised at this temperature, the product may contain the labile form of the di-iodate.

In the system  $\text{NaIO}_3\text{—HIO}_3\text{—H}_2\text{O}$ , it is found that, contrary to Blomstrand's statement (Abstr., 1890, 107), the tri-iodate  $\text{NaIO}_3\text{,2HIO}_3$  is anhydrous, and that, contrary to Penny's statement, the salt  $\text{NaIO}_3\text{,HIO}_3$  does not exist, but instead the pyro-compound  $\text{Na}_2\text{O,2I}_2\text{O}_5$ . This pyro-salt is slowly formed from certain definite proportions of the three components.

In the system  $\text{NH}_4\text{IO}_3\text{—HIO}_3\text{—H}_2\text{O}$ , only the known ammonium tri-iodate is obtained. The di-iodate is not capable of existence at  $30^\circ$ .

D. H. J.

**Chemical and Electrical Examination of the Equilibria:**  $\text{HIO}_3 + 5\text{HI} \rightleftharpoons 3\text{I}_2 + 3\text{H}_2\text{O}$  and  $\text{HBrO}_3 + 5\text{HBr} \rightleftharpoons 3\text{Br}_2 + 3\text{H}_2\text{O}$ . ROBERT LUTHER and G. V. SAMMET (*Zeit. Elektrochem.*, 1905, 11, 293—295).—In acid solutions the equilibrium  $\text{HIO}_3 + 5\text{HI} \rightleftharpoons 3\text{I}_2 + 3\text{H}_2\text{O}$  leads to the formation of the substances on the right hand, those on the left being formed in alkaline solutions. In a solution saturated with sodium borate and boracic acid, which contains  $6.5 \times 10^{-7}$  mols.  $\text{H}^+$  at  $25^\circ$ , the concentrations of all the substances are measurable analytically, but equilibria between iodine and water and hydriodic acid and oxygen, the constants of which are unknown, interfere with the measurement. The concentrations of the  $\text{I}'$  and  $\text{IO}_3'$  ions may, however, be made constant by shaking a solution of iodine with solid silver iodide and iodate. Equilibrium is attained in about 7 weeks at  $25^\circ$  or in 4 days at  $60^\circ$ . The values of the equilibrium constant  $K = [\text{H}']^6[\text{IO}_3']/[\text{I}']^5[\text{I}_2]^3$  are  $2.8 \times 10^{-47}$  at  $25^\circ$  and  $5.2 \times 10^{-42}$  at  $60^\circ$ . From these values the heat of the reaction  $\text{HIO}_3 + 5\text{HI} + \text{aq} = 3\text{I}_2(\text{dissolved}) + \text{aq}$  is calculated to be 68.3 Cals.; thermochemical experiments give 64.2 Cals. The *E.M.F.* of the cell



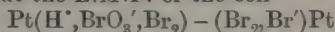
is 0.549 volt at  $25^\circ$ , the value calculated from the equilibrium constant above given being 0.5493 volt.

The *E.M.F.* of the iodate-iodine electrode was measured against the calomel electrode and found to vary with the concentrations of  $\text{H}^+$ ,  $\text{IO}_3^-$  and  $\text{I}_2$  in the way required by the theoretical equation  $E(\text{electrode}) - E(\text{drop electrode}) = E_o + (RT/10F)\log([\text{H}^+]^{12}[\text{IO}_3^-]^2/[\text{I}_2])$ . This is the first case in which the theoretical connection between the *E.M.F.* and the concentrations of three different substances has been found to hold good quantitatively. The value of  $E_o$  at  $25^\circ$  is 1.454 volts.

In connection with the above measurements, the solubility of iodine in water was found to be 0.001341 gram mol. per litre at  $25^\circ$  and 0.00416 gram mol. per litre at  $60^\circ$ , from which its molecular heat of solution is  $-6.37$  Cals. The solubility of silver iodide at  $60^\circ$  is  $1.08 \times 10^{-7}$  gram mols. per litre.

The solubility of silver iodate at  $25^\circ$  and  $60^\circ$  is  $2.16 \times 10^{-4}$  and  $6.54 \times 10^{-4}$  gram mols. per litre, and its heat of precipitation 12.5 Cals. The electrical conductivities of sodium iodate, nitric and iodic acids at  $25^\circ$  and  $60^\circ$  are also given.

The equilibrium  $\text{HBrO}_3 + 5\text{HBr} \rightleftharpoons 3\text{Br}_2 + 3\text{H}_2\text{O}$  could not be determined chemically, but the *E.M.F.* of the cell



was found to be 0.393 volt at  $25^\circ$ . From this figure the equilibrium constant at  $25^\circ$   $[\text{H}^+]^6[\text{BrO}_3^-][\text{Br}^-]^3/[\text{Br}_2]^3 = 7.3 \times 10^{-34}$ .

The *E.M.F.* of the bromic acid - bromine electrode follows a formula similar to that above given for iodine, the constant  $E_o = 1.764$  volt at  $25^\circ$ .

T. E.

**Hydration in Solution.** GILBERT N. LEWIS (*Zeit. physikal. Chem.*, 1905, 52, 224—230).—The author criticises adversely Jones and Getman's method of estimating quantitatively the degree of hydration in a salt solution (Abstr., 1904, ii, 710), mainly because it leads in many cases to the result that the degree of hydration increases with the concentration of the solute (see also Biltz, Abstr., 1904, ii, 710). At the same time Jones and Getman's experimental work is considered to be valuable because it indicates the probable relative hydration for different salts.

The author has made some experiments on the colour changes shown by solutions of cobalt chloride, copper chloride and bromide, and considers that these colour changes are associated with the varying degree of hydration of these salts.

[*Note by Abstractor.*—The author makes no reference to the recent paper by Donnan and Bassett (Trans., 1902, 81, 939) dealing with the colour changes shown by the chlorides of cobalt and other metals.]

J. C. P.

**Influence of Temperature on the Amount of Water of Crystallisation as Evidence supporting the Theory of the Existence of Hydrates in Solution.** HARRY C. JONES and H. P. BASSETT (*Zeit. physikal. Chem.*, 1905, 52, 231—235).—The earlier work (Jones and Getman, Abstr., 1904, ii, 235, 386, 710) has indicated the existence of hydrates in salt solutions, the stability



of these hydrates diminishing as the temperature rises. The latter phenomenon is now correlated with the well-known general fact that the number of molecules of water with which a salt crystallises from water diminishes as the temperature rises.

The fact that a concentrated solution of cobalt chloride turns blue when shaken with crystallised calcium chloride is attributed to the dehydration of the cobalt chloride. The conclusion is drawn that a salt (calcium chloride in the foregoing special case) can combine in solution with more molecules of water than it can carry with it out of the solution in the form of water of crystallisation (see, however, Donnan and Bassett, *Trans.*, 1902, 81, 939). J. C. P.

**Solubilities in Mixtures of Solvents. II.** WALTER HERZ and M. KNOCH (*Zeit. anorg. Chem.*, 1905, 45, 262—269. Compare *Abstr.*, 1904, ii, 709).—The solubilities were determined at 25° as described in the former paper.

(I.) Determinations of Solubility in Mixtures of Acetone and Water.—Potassium bromide is almost insoluble in pure acetone; in aqueous acetone its solubility varies in a similar manner to that of potassium chloride.

Ammonium chloride behaves like sodium chloride. With mixtures of acetone varying from 46.5 pts. of acetone (by volume) and 53.5 pts. of water to 85.7 pts. of acetone and 14.3 pts. of water, the addition of ammonium chloride causes the formation of two layers.

Sulphur is slightly soluble in acetone; its solubility is less in presence of water at 25°. Bodländer suggested that the quotient  $W/\sqrt[3]{S}$  is a constant for solutions in aqueous alcohol ( $W$  being the number of grams of water and  $S$  the number of grams of the dissolved substance in 100 c.c. of the mixed solution). The results of the present paper show that Bodländer's formula is applicable to sugar, ammonium chloride, or sulphur, but not to barium chloride or potassium bromide in solution in aqueous acetone.

(II.) Solubilities in Aqueous Alcohol.—Mercuric iodide was chosen as a substance sparingly soluble in water but easily soluble (1.754 pts. at 25°) in alcohol. Bodländer's formula (which is here of the form alcohol /  $\sqrt[3]{S}$ , since the alcohol and not the water is the constituent which promotes solution) appears to be applicable.

(III.) Solubilities in Aqueous Glycerol.—In the case of succinic acid, potassium bromide, potassium chloride, sodium chloride, and ammonium chloride, the solubility diminishes as the percentage of glycerol increases. The conditions for the application of Bodländer's formula are not obtained, as the solubility of the above substances in pure glycerol is not inconsiderable.

The solubility of boric acid in aqueous glycerol changes little up to 7 per cent. of glycerol or more, but as the percentage of glycerol is still further increased the solubility rapidly becomes greater, probably owing to the formation of a complex of boric acid and glycerol.

The solubility of iodine in glycerol is small, but much more considerable than in water. Bodländer's formula is approximately applicable. D. H. J.

**Reactions which take place in Several Stages.** ERICH BRUNNER (*Zeit. physikal. Chem.*, 1905, 52, 89—96. Compare Jungius, Abstr., 1904, ii, 716).—A theoretical paper in which is considered the application of the law of mass action to chemical changes involving the formation, or the possible formation, of an intermediate compound. For a chemical change which can be analysed into two partial processes or stages, it is impossible to deduce anything as to the relative velocity of the two component reactions from the two corresponding equilibria.  
J. C. P.

**Nuclear Synthetical Equilibrium between Phenols, Bicarbonates, and Phenolcarboxylic Acids in Aqueous Solution.** JOH. A. AF HÄLLSTRÖM (*Ber.*, 1905, 38, 2288—2290. Compare Skraup, Abstr., 1890, 136).—If phloroglucinol and potassium hydrogen carbonate or phloroglucinol and potassium phloroglucinolcarboxylate are dissolved in water through which a current of oxygen-free carbon dioxide is passed, after some days at 50° a state of equilibrium is reached between phloroglucinol, potassium phloroglucinolcarboxylate, and potassium hydrogen carbonate. The equilibrium is represented by the formula

$$\frac{\text{Phl} \cdot \text{H} \times \text{HCO}_3'}{\text{Phl} \cdot \text{CO}_2'} = \frac{\text{Phl} \cdot \text{H} \times a' \text{KHCO}_3}{a'' \text{Phl} \cdot \text{CO}_2 \text{K}} = \text{constant},$$

where Phl =  $\text{C}_6\text{H}_2(\text{OH})_3$ , and  $a'$  and  $a''$  are the degree of dissociation of the potassium salts. In eight experiments, assuming  $a'$  and  $a''$  to be approximately the same, the constant was found =  $0.115 \pm 0.015$ .

G. Y.

**Hydration and Hardening.** PAUL ROHLAND (*Zeit. Elektrochem.*, 1905, 11, 338).—A reply to Jordis (this vol., ii, 155).  
T. E.

**Autocatalysis and the Transformation of  $\gamma$ -Hydroxy Acids, with and without Addition of other Acids, conceived as an Ionic Reaction.** ARIE W. VISSER (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 7, 760—769).—If it is supposed that the change in intensity of the catalyst with the change in concentration of the reacting substance is constant, then  $-dI/dC = k_2$ , whence  $I = k_1 - k_2 C$ . The equation for unimolecular reaction, when the intensity of the catalyst is taken into account, is  $-dC/dt = kCI$ , which for the particular case referred to becomes  $-dC/dt = k(k_1 - k_2 C)C$ .

Using the experimental data obtained by Henry (Abstr., 1892, 1303), the author shows that the transformation of  $\gamma$ -hydroxy-acids into their lactones may be satisfactorily represented as being a reaction between the positive and negative ions.  
J. C. P.

**Theory of Colloids.** HEINRICH BECHHOLD (*Zeit. Elektrochem.*, 1905, 11, 339—340).—A reply to Jordis (this vol., ii, 447).  
T. E.

**Osmotic Pressure of Colloidal Solutions.** JACQUES DUCLAUX (*Compt. rend.*, 1905, 140, 1544—1547).—The granules of a colloidal solution may be regarded as ions of a large size in that they are conductors of electricity (compare this vol., ii, 432), and exert a specific osmotic pressure which can be measured by placing the

solution in a vertical cylinder with collodion walls and measuring the difference between the levels of the internal and external liquid after diffusion has occurred. The ratio between the osmotic pressure and the electrolytic conductivity of colloidal solutions of different concentrations is not constant, because the properties of the granules of such solutions vary with their concentration.

M. A. W.

**Equilibrium between Proteids and Electrolytes. I. Equilibrium in the System Egg-albumin, Ammonium Sulphate, and Water.** GINO GALEOTTI (*Zeit. physiol. Chem.*, 1905, 44, 461—471. Compare Abstr., 1904, i, 355).—The precipitation of egg-albumin by ammonium sulphate is a completely reversible process. The precipitation begins when the concentration of the salt has reached a certain limit, and the addition of more saturated sulphate solution produces further precipitation until with a completely saturated solution no albumin remains in solution. The addition of water causes the albumin to redissolve. The various precipitates obtained by fractional precipitation have the same composition. The crystalline needles and globulites obtained by evaporating a clear solution of albumin and ammonium sulphate consist of pure albumin.

The points of equilibrium are represented by means of isothermals in a triangle.

When an albumin solution is mixed with a certain quantity of saturated ammonium sulphate solution a precipitate appears only after some time, and thus a system in labile equilibrium is formed which exists for some time as a clear solution and then separates into two phases. This system has also been represented by isotherms.

J. J. S.

**Solid Peptone Membranes on a Water-surface, and the Cause of their Formation.** WILMOT V. METCALF (*Zeit. physikal. Chem.*, 1905, 52, 1—54. Compare Ramsden, Abstr., 1904, ii, 323).—When a drop of a peptone solution is allowed to fall on water, it spreads itself completely over the free water-surface and over the moistened walls of the containing vessel, forming a fine membrane which is stronger at 0° than at 18° and increases in strength up to a certain point as time goes on. A drop of the peptone solution cannot, however, spread itself over dry glass. A membrane obtained in the aforementioned manner has the same properties whether it is formed in an atmosphere of oxygen or of hydrogen, and it allows the free evaporation of the water below. An already-formed membrane which is fairly strong does not expand noticeably when brought into contact with a fresh water-surface, although an expansion may be detected when the membrane is weak. The minimum quantity of peptone required for the formation of a solid membrane is about  $4 \times 10^{-7}$  grams per square centimetre. It has been shown that a well-defined solid membrane can be formed also from a pure peptone compound. The surface tension of peptone solutions diminishes as the concentration increases. Various hypotheses relating to the observed phenomena are discussed, and the view is adopted that the peptone membranes are an



experimental realisation of Gibbs' thermodynamical principle, according to which a chemical change may be caused by surface tension.

J. C. P.

**Formation of Structures in Jellies.** HEINRICH BECHHOLD (*Zeit. physikal. Chem.*, 1905, 52, 185—199).—The paper deals with the phenomena of intermittent precipitation studied by Liesegang, Morse and Pierce (*Abstr.*, 1904, ii, 14), and Hausmann (*ibid.*, 547). The reaction specially considered is the precipitation of silver nitrate by ammonium chromate or dichromate, and it is shown that silver chromate is slightly soluble in ammonium chromate and in the ammonium nitrate formed. If then silver nitrate is allowed to diffuse into a jelly containing ammonium chromate, the ammonium nitrate produced in the first precipitation zone will have an effect in preventing the precipitation of more silver chromate in its immediate neighbourhood. Only in a region in which the concentration of ammonium nitrate has sufficiently fallen off will fresh precipitation of silver chromate take place. Other factors also may be concerned in the observed intermittent precipitation, as, for example, the power of ions to promote or hinder the precipitation of suspensions or colloidal solutions, the manner in which the setting point of the gelatin is affected by the diffusion into it of the various salts, and the ability of colloids to precipitate each other only when mixed in certain proportions.

J. C. P.

**Influence of Electrolytes on the Mutual Precipitation of Colloids of Opposite Electrical Sign.** LARGUIER DES BANCELS (*Compt. rend.*, 1905, 140, 1647—1649).—By means of a series of experiments with such "couples" of colloids as colloidal ferric hydroxide (positive) with aniline-blue (negative), and colloidal arsenic sulphide (negative) with methyl-violet (positive), the author has found that the mutual precipitation of colloids of opposite sign is partially inhibited by the previous addition of an electrolyte, that the precipitate formed by the mixture of solutions of two such colloids is dissociated by the addition of an electrolyte capable itself of precipitating one of the reacting colloids, and finally, that when an electrolyte is added to a solution of a colloid (*a*) which it does not precipitate, and to the mixture a second colloid (*b*) of opposite sign is added, precipitation always takes place. With small quantities of electrolyte present, the precipitate is a mixture of *a* and *b*; with larger quantities of electrolyte, it consists of *b* alone; and if the quantity of electrolyte is again increased, both *a* and *b* are again precipitated.

T. A. H.

**Miscibility in the Solid State, and Isomorphism, in the case of Carbon Compounds.** F. M. JAEGER (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 7, 658—666).—In recent years it has been shown that many organic substances yield mixed crystals and solid solutions, but it is not permissible to draw conclusions as to existing isomorphism solely from the course of the melting or solubility curves for two components. It is accordingly thought desirable to investigate thoroughly the miscibility and crystallographic relationship of pairs

of organic substances, and in this communication the author deals with *p*-nitrodiethylaniline and *p*-nitrosodiethylaniline (compare Bruni and Callegari, *Abstr.*, 1904, ii, 545). It is found that these two compounds are completely isomorphous and also completely miscible in the solid state.

J. C. P.

**Fundamental Laws of Stoichiometry and the Atomic Theory.** The Faraday Lecture by W. Ostwald. RAFFAELLO NASINI (*Memor. R. Accad. Lincei*, 1905, [v], 5, 119—153).—This memoir contains a criticism of the views of Ostwald expressed in his Faraday Lecture (*Trans.*, 1904, 85, 506—522), and is unsuitable for abstraction.

T. H. P.

**Periodic Classification of the Elements.** ALFRED WERNER (*Ber.*, 1905, 38, 2022—2027).—A reply to Abegg (this vol., ii, 380). In the periodic classification of the elements, Abegg's conception of choosing the periods to be double or several times eight cannot be accepted. The system must be based on the periods as differentiated by the atomic volume curve.

A. McK.

**Periodic Classification of the Elements.** RICHARD ABEGG (*Ber.*, 1905, 38, 2330—2334).—A reply to Werner (preceding abstract).

A. McK.

**New Forms of Lecture and Laboratory Apparatus.** GEORGE B. FRANKFORTER and FRANCIS C. FRARY (*J. Amer. Chem. Soc.*, 1905, 27, 744—747).—Certain forms of apparatus suitable for lecture and laboratory purposes are described for (a) the determination of the hydrogen equivalent of zinc, (b) the preparation of sulphuric acid, and (c) the demonstration of Charles' law. For details, the description and diagrams in the original must be consulted.

E. G.

**New Apparatus.** S. P. BEEBE and B. H. BUXTON (*Amer. J. Physiol.*, 1905, 14, 7—11).—Some pieces of laboratory apparatus (an automatic compressed air and vacuum apparatus, a centrifuge, a drying apparatus, and an electric water-bath) are described and figured.

W. D. H.

**A New Form of Test-tube.** EDUARD SCHAEER (*Zeit. anal. Chem.*, 1905, 44, 396—397).—The tube described is of Jena glass, and is 17 mm. in diameter and 120 mm. in height. The lower end is widened out to a diameter of 28 mm. and the bottom is flat, so that the tube will stand upright. The tube will bear heating, and is suitable for a variety of operations.

W. P. S.

**Two Modifications of the Töpler Mercury Air Pump.** ALFRED STOCK (*Ber.*, 1905, 38, 2182—2185).—Two new modifications of the Töpler pump are described and figured; they have the advantage of being small and easily transported, they work quickly and easily, the mercury does not come into contact with india-rubber or fat, and so keeps clean; whilst, lastly, they are easily manipulated and can even be arranged to work automatically.

E. F. A.

## Inorganic Chemistry.

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**Purification and Sterilisation of Drinking-water by means of Calcium Peroxide.** L. FREYSSINGE and RAOUL ROCHE (*Rev. intern. Falsif.*, 1905, 18, 49—51).—The addition of about 0.4 gram of calcium peroxide per litre to water completely sterilises the latter. The action is not instantaneous, but in most cases takes about 2 hours. After 3 hours, no living bacteria were found in a water which originally contained 355,000 *Bacilli coli communis* and 171,000 *B. typhosus* per c.c. The peroxide is more rapidly decomposed when a little sodium hydrogen carbonate is added to the water, and the sterilisation is then completed in about 15—20 minutes. The hydrogen peroxide resulting from the decomposition of the calcium peroxide may be removed, together with the precipitate of calcium carbonate, by filtration through manganese dioxide. The hardness of the water is generally diminished by this treatment. If stored in closed bottles, the sterilised but unfiltered water can be kept for a long time before using for drinking. W. P. S.

**Use of Barium Carbonate for the Purification of Water.** E. E. BASCH (*Chem. Zeit.*, 1905, 29, 721).—Experiments on a small scale on the softening of water by means of barium carbonate gave good results when an excess of the precipitant was used, and when it was thoroughly mixed with the water. A. McK.

**Function of the Catalyst in the Deacon Process for the Manufacture of Chlorine.** MARIO G. LEVI and V. BETTONI (*Gazzetta*, 1905, 35, i, 320—342).—From experiments on the interaction of hydrogen chloride and dry air in presence of pumice impregnated with copper salts as catalysts, the authors conclude that the reaction is slowly initiated by the joint action of the high temperature and the pumice and is accelerated by the copper salt, the function of which is to absorb the water formed during the reaction.

An account is given of the different views previously published as to the mechanism of the process. T. H. P.

**Apparatus for the production of Chlorine, Carbon Dioxide, Hydrogen Sulphide, &c.** CARL ECKART (*Zeit. anal. Chem.*, 1905, 44, 398—399).—The evolution part of the apparatus consists of a three-necked Woulfe's bottle. The stem of a tapered funnel is ground into the middle neck, a tube leads from one of the other necks to the top of the funnel, and the third neck carries the delivery-tube. The latter passes to a wash bottle containing a little water, from which the gas is led to the bottom of a large flask nearly filled with water and surrounded by a vessel containing ice-water. A side-tube, leading from the top of this flask, passes into a wash-bottle containing water to the height of about 15 cm. By the slight pressure thus produced, a concentrated solution of the gas is obtained in the flask, and scarcely



any of the gas escapes into the room. The gas is produced by allowing hydrochloric acid to fall drop by drop from the tapped funnel on to marble, bleaching powder, &c., contained in the Woulfe's bottle. India-rubber connections and screw-cocks are provided between the various parts of the apparatus.

W. P. S.

**Ozonising of Oxygen and Atmospheric Air by the Discharge from Metallic Points.** E. WARBURG (*Ann. Physik*, 1905, 17, 1—29).—A continuation of the author's previous paper (*Abstr.*, 1904, ii, 24). The arsenious acid and potassium iodide methods for the estimation of ozone are compared, the latter being considered preferable. The influence of pressure on the ozonisation has been investigated, and the yield per ampere-minute is found to increase with increasing pressure. This the author considers to be due solely to the greater number of molecules encountered by the ions, and not to increase in the ozonising power. At constant pressure, the yield decreases with rise of temperature, but at constant concentration the effect of temperature is slight, a rise from the ordinary temperature to 80° causing a small increase for small currents and a small decrease for higher currents. It has been shown previously that with a negative potential the yield is greatest for very small currents, and it is further found that with increasing current a minimum is reached, after which the yield again rises. With positive potential, the yield increases with the current, so that the potential should be near the sparking point; it increases also with increasing distance between point and plate, but this distance cannot be too great owing to the decreasing current. The ozonisation of atmospheric air has also been investigated: with a negative point the yield is about one-fifth of that obtained with pure oxygen, but with a positive point the value increases to about one-half. The author considers his work further confirms his previous opinion that the ozone production is due to photo- and cathodo-chemical action.

L. M. J.

**Reduction of Sulphates.** CAMILLO BRÜCKNER (*Monatsh.*, 1905, 26, 675—682).—The author has studied the reduction of anhydrous sulphates by heating with magnesium powder in an atmosphere of nitrogen in a test-tube. If more than one atom of magnesium be mixed with each mol. of sulphate, the reaction increases in violence without any change in the final products. The reduction is accompanied, except in the case of the alkali sulphates, by an evolution of sulphur dioxide, which takes place with explosive violence if more than 0.3 gram of the reaction mixture is heated at once.

The reduction of the alkali sulphates is accompanied by intense luminosity of the mixture; the reaction products, which become red on cooling or green on exposure to air, contain polysulphides and thio-sulphates, and yield alkaline solutions when extracted with water; the products are not altered if the reaction is carried out in an open tube or in a crucible.

The reduction of the sulphates of magnesium, calcium, barium, zinc, aluminium, or nickel by magnesium powder results in the formation of sulphur dioxide, sulphur, magnesium oxide, and the

oxide, sulphide, and thiosulphate of the metal ; owing to the ease with which cupric oxide is reduced, the residue from the reduction of copper sulphate contains also cuprous oxide and copper, whilst manganese and ferric sulphates, which possess strong tendencies to auto-oxidation, yield the higher oxides of the metals along with the sulphides and thiosulphates.

Reduction of these sulphates with formation of the sulphides takes place also when the anhydrous salts are ground with magnesium powder in a mortar.

The formation of the thiosulphate may be due to the action of liberated sulphur on intermediately formed sulphite, or to the interaction of sulphur, magnesium oxide, and sulphur dioxide, as when these are heated together and the product extracted with water the aqueous solution contains the thiosulphate.

As sulphur trioxide appears as an intermediate product in the reduction of some unstable sulphates, it was passed over heated magnesium powder, when sulphur dioxide was evolved, and the residue contained magnesium oxide and sulphide. G. Y.

**Selenic Acid.** WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1905, 150—151).—The sp. gr. of three commercial samples of selenic acid were: No. 1, 1.4669 at 15.5°, No. 2, 1.4386 at 18°, and No. 3, 1.4698 at 15.8°. The sp. gr. of several mixtures of selenic acid and water at different temperatures are tabulated in the original.

T. A. H.

**The True Atomic Weight of Nitrogen.** GUSTAV D. HINRICHS (*Compt. rend.*, 1905, 140, 1590—1591).—The author draws attention to the fact that the values recently obtained by Guye for the atomic weight of nitrogen (compare Abstr., 1904, ii, 475, 557, 812) closely approach the value 14.00, which he maintains is the true atomic weight of nitrogen (compare Abstr., 1893, ii, 163, 277, 316, 317; 1894, ii, 39, 87, 276; 1900, ii, 534, 539).

M. A. W.

**Oxidation of Atmospheric Nitrogen in the High Tension Arc.** ALFRED STAVENHAGEN (*Ber.*, 1905, 38, 2171—2177).—Air was forced at known rates through a cooled porcelain tube containing two iron electrodes; the tension was about 20,000 volts and the current 0.07 ampere, the discharge being a continuous greenish-yellow flame. Large quantities of oxides of nitrogen were formed, the yield being a maximum when air was forced through at a velocity of 180 litres per hour. It is impossible to completely condense all the oxides of nitrogen formed in this manner even by means of liquid air.

E. F. A.

**Constitution of Frémy's Sulphazilate and Pelouze's Nitrosulphate.** EDWARD DIVERS (*Ber.*, 1905, 38, 2252).—A correction (compare this vol., ii, 449).

W. A. D.

**Action of Fluorine on Oxygenated Compounds of Nitrogen.** HENRI MOISSAN and PAUL LEBEAU (*Compt. rend.*, 1905, 140, 1573—1577).—The authors have examined the behaviour of fluorine

with the oxides of nitrogen, it having been previously observed that it reacts violently with nitric acid (compare Moissan, *Ann. Chim. Phys.*, 1891, [vi], 24, 251). Fluorine has no action on nitrogen peroxide or nitrous oxide at the ordinary temperature.

When a mixture of nitrous oxide and fluorine is heated electrically by means of a platinum spiral, platinum fluoride is formed at  $400^{\circ}$ , or if the two gases are heated to redness in a glass vessel, silicon fluoride and oxygen are formed, whilst the nitrous oxide remains unaltered. When a mixture of nitrous oxide and fluorine is submitted to the action of an induction spark in the presence of mercury, there is a complex reaction, the mercury is attacked, and the final gaseous mixture contains oxygen, nitrogen, and nitrous oxide, but no compound of nitrogen and fluorine. Fluorine combines with nitric oxide with production of a pale yellow flame, and when the nitric oxide is in excess no volatile compound of fluorine is obtained, but the heat developed by the reaction decomposes the nitric oxide into nitrogen and oxygen, the oxygen reacting with the excess of nitric oxide to form nitrogen peroxide. By the action of nitric oxide on excess of fluorine at the temperature of liquid oxygen, a white solid is obtained, which yields on vaporisation fluorine and a colourless liquid boiling above  $-80^{\circ}$ , and containing nitrogen, fluorine, and oxygen.

M. A. W.

**Preparation and Properties of Nitroxyl Fluoride (Nitryl Fluoride).** HENRI MOISSAN and PAUL LEBEAU (*Compt. rend.*, 1905, 140, 1621—1626. Compare preceding abstract).—By repeated fractional distillation of the white solid obtained by the action of excess of fluorine on nitric oxide at the temperature of liquid oxygen, all the dissolved fluorine is removed and the residue, which is liquid at  $-80^{\circ}$ , is *nitroxyl fluoride (nitryl fluoride)*,  $\text{NO}_2\text{F}$ , its preparation from nitric oxide and fluorine being represented by the equation  $4\text{NO} + \text{F}_2 = 2\text{NO}_2\text{F} + \text{N}_2$ . Nitroxyl fluoride is a colourless gas which attacks the mucous membrane, producing a painful and persistent irritation; it melts at  $-139^{\circ}$ , boils at  $-63.5^{\circ}$ , has a density 2.17—2.31 at  $0^{\circ}$ , the theoretical value being 2.26; it does not combine with hydrogen, sulphur, or carbon in the cold, but reacts at the ordinary temperature with boron, silicon, phosphorus, arsenic, antimony, iodine, the alkali metals, and the metals of the alkaline earths, thorium, aluminium, iron, or mercury; it decomposes cold water, producing hydrofluoric acid and nitric acid; the reaction is quantitative and has served in the analysis of the compound; it also reacts with a large number of organic compounds, yielding, with benzene, nitrobenzene and a volatile product which attacks the eyes.

M. A. W.

**Silicochloroform.** OTTO RUFF and KURT ALBERT [and, in part, EMIL GEISEL] (*Ber.*, 1905, 38, 2222—2243).—Silicochloroform is best prepared according to Combe's method by the action of dry hydrogen chloride on commercial 20 per cent. copper silicide; the gaseous product is condensed by passing it through a worm surrounded by a freezing mixture, the receiver being kept in liquid air. The pure substance obtained after very careful fractionation boils at  $33^{\circ}$  under 758 mm. pressure, melts and solidifies at  $-134^{\circ}$  (air thermometer), and has a sp. gr. 1.3438 at  $15^{\circ}$ ; from the latter value, the atomic



volume of silicon in silicochloroform is 58.33. Silicochloroform is completely miscible with carbon disulphide, carbon tetrachloride, chloroform, silicon tetrachloride, stannic chloride, titanous chloride, and arsenic trichloride. It decomposes at  $800^{\circ}$  according to the equation  $4\text{SiHCl}_3 \rightleftharpoons \text{Si} + 3\text{SiCl}_4 + 2\text{H}_2$ , the action being reversible; it is, however, not attacked at  $150^{\circ}$  by sodium, sodium amalgam, mercury, copper, tin, sulphur, or aluminium chloride. Chromic anhydride decomposes it at  $160^{\circ}$  apparently according to the equation  $3\text{SiHCl}_3 + 5\text{CrO}_3 = \text{Cr}_2\text{O}_3 + 3\text{SiO}_2 + 3\text{Cr}_2\text{O}_3\text{Cl}_2 + 3\text{HCl}$ ; with sulphur trioxide at the same temperature, the following action occurs:  $2\text{SiHCl}_3 + 4\text{SO}_3 = \text{SO}_2\text{Cl}_2 + \text{HCl} + \text{SiO}_2 + 2\text{SO}_2 + \text{SiOCl}_2 + \text{SO}_3\text{HCl}$ . Dry sulphur dioxide leaves a large proportion of the silicochloroform unchanged, but the following action also occurs:  $\text{SO}_2 + 2\text{SiHCl}_3 = \text{S} + \text{SiO}_2 + \text{SiCl}_4 + 2\text{HCl}$ . With arsenious oxide moistened with sodium hydroxide solution, the action  $\text{As}_2\text{O}_3 + 18\text{NaOH} + 3\text{H}_2\text{O} + 6\text{SiHCl}_3 = 18\text{NaCl} + 6\text{Si(OH)}_4 + \text{As}_2$  appears to take place; with antimony oxide, a similar change occurs, antimony being liberated. Arsenic trichloride, stannic chloride, boron trichloride, and titanium tetrachloride are not changed by silicochloroform at  $150^{\circ}$ , but bring about a catalytic decomposition of the latter, hydrogen being formed.

On passing dry gaseous ammonia mixed with hydrogen into a Woulfe's bottle, cooled at  $15^{\circ}$ , into which silicochloroform diluted with hydrogen is simultaneously led, a white powder having the composition  $\text{N}:\text{SiH}, 3\text{NH}_4\text{Cl}, 0.2\text{NH}_3$  is obtained; the ammonium chloride may be almost completely removed by washing the product with liquefied ammonia in an apparatus from which moisture is excluded; but attempts to remove the ammonia completely, either at the ordinary temperature in a vacuum, or at  $100^{\circ}$ , cause partial decomposition according to the equation  $\text{SiNH} + \text{NH}_3 = \text{Si(NH)}_2 + \text{H}_2$ .

*Siliconitrogen hydride*,  $\text{SiH:N}$ , is a white powder with a caustic taste, which is decomposed by water or sodium hydroxide solution giving hydrogen, thus:  $\text{SiHN} + 4\text{NaOH} = \text{Si(ONa)}_4 + \text{NH}_3 + \text{H}_2$ ; the action is quantitative. It has all the reducing properties of silicoformic anhydride, and is converted by dry hydrogen chloride at  $300^{\circ}$  into silicochloroform and ammonium chloride.

W. A. D.

**New Allotropic Form of Carbon and its Heat of Combustion.** WILLIAM G. MIXTER (*Amer. J. Sci.*, 1905, 19, 434—444).—The heat of combustion of 1 gram of carbon obtained by the decomposition of acetylene is found to be 7894 cals., the corresponding values for sugar charcoal and graphite being respectively 8057 and 7831. The value is hence very different from that for amorphous carbon and approaches that for graphite. Moissan has, however, shown that this carbon is not graphite. It has a sp. gr. 1.919 at the ordinary temperature. It is found that it does not exert the catalytic actions of charcoal, and that it only absorbs 0.1 per cent. of its weight of moisture from the atmosphere. When heated with sulphuric acid, there is no odour of sulphur dioxide.

L. M. J.

**Mutual Relationships of the Different Modifications of Carbon.** RUDOLF SCHENCK and W. HELLER (*Ber.*, 1905, 38, 2139—2143).—Starting with the equation  $P = \zeta.1 + \eta/\eta^2$ , where  $P$  is the

total gas pressure,  $\zeta$  is the equilibrium constant for the system C, CO, CO<sub>2</sub>, and  $\eta$  the similar constant for the system Fe, FeO, CO, CO<sub>2</sub>; since  $\eta$  does not vary with different varieties of carbon, it follows that at constant temperature the value of  $\zeta$  for the various modifications of carbon is proportional to the total gaseous pressure. The pressures have been determined at temperatures between 400° and 800°, when the various varieties of carbon are in equilibrium with metallic iron, ferrous oxide, and the oxides of carbon. The apparatus employed was the same as for the experiments already described (this vol., ii, 526). The ferrous oxide was obtained by heating dry ferrous oxalate at 300° under reduced pressure in a quartz tube and in the presence of powdered carbon. The mixture was then heated to a higher temperature, when part of the carbon reduced the ferrous oxide, all gases were removed, and the pressure determined when equilibrium was attained. The results show that at the same temperature the highest pressures are given by amorphous carbon and the lowest by graphite. Powdered diamond is intermediate between the two, but the values approximate closely to those of amorphous sugar carbon. The powdered carbon obtained by decomposing carbon monoxide gives values identical with those for graphite. Within the temperature limits examined, the temperature-pressure curves do not cut one another, and within these temperatures graphite is the most stable modification.

It follows that for any given temperature in a blast furnace worked with wood charcoal the composition of the gaseous mixture will be different (richer in carbon monoxide) from the gaseous mixture of a furnace worked with coke (which is allied to graphite).

J. J. S.

**State in which Helium exists in Pitchblende.** RICHARD J. MOSS (*Sci. Trans. Roy. Dubl. Soc.*, 1904, [ii], 8, 153—160).—Pitchblende was first ground in a vacuum and then decomposed by fusion with potassium hydrogen sulphate. The helium liberated by grinding in a vacuum was 1.17 per cent. of the total quantity present in one specimen, 1.11 per cent. of the total quantity in another specimen. The total quantity of helium obtained per gram of mineral was 0.107 c.c. in the first case, 0.082 c.c. in the second case. The first specimen yielded also in all 4.686 c.c. of carbon dioxide per gram, but of this only 0.0085 per cent. was obtained by grinding in a vacuum. Water vapour is by far the most abundant of the substances liberated by grinding pitchblende in a vacuum.

There is a strong presumption that, although no cavities can be detected in pitchblende by microscopic examination, they nevertheless exist, and it is probable that the helium is contained in such cavities. The most minute subdivision that can be effected by mechanical means would open only a small proportion of these cavities.

J. C. P.

**Transformation of Potassium Chlorate into Iodate by Iodine in presence of Nitric Acid.** MAX SCHLÖTTER (*Zeit. anorg. Chem.*, 1905, 45, 270—274).—The transformation of potassium chlorate into the iodate by heating with iodine in presence of nitric acid is dependent

(1) on the concentration of the acid. With dilute acid the reaction is:  $10\text{KClO}_3 + 6\text{I}_2 = 10\text{KIO}_3 + 2\text{HIO}_3 + 10\text{HCl}$ ; with more concentrated acid:  $2\text{KClO}_3 + \text{I}_2 = 2\text{KIO}_3 + \text{Cl}_2$ . (2) On the proportions of iodine to perchlorate. With  $\text{KClO}_3:\text{I}_2 = 2:1$  the reaction is:  $2\text{KClO}_3 + \text{I}_2 = 2\text{KIO}_3 + \text{Cl}_2$ ; with  $\text{KClO}_3:\text{I}_2 = 1:1$ , the reaction is:  $\text{KClO}_3 + \text{I}_2 = \text{KIO}_3 + \text{ICl}$ .  
D. H. J.

**Specific Gravities of Sodium Carbonate and Sodium Hydroxide Solutions.** RUDOLF WEGSCHEIDER and HEINRICH WALTER (*Monatsh.*, 1905, 26, 685—725).—Sp. gr. determinations are given for solutions of sodium carbonate and of sodium hydroxide, as well as of mixtures of these at temperatures between  $60^\circ$  and  $80^\circ$ . The sp. gr. of pure solutions of these salts of a strength not greater than  $8N$ , at temperatures between  $0-100^\circ$  or  $15-80^\circ$  respectively, are represented by the equation  $d_t = d_w' + (a + bt + ct^2)X + (a' + b't + c't^2)X^2$ , where  $d_w'$  is the sp. gr. of pure water at the given temperature,  $X$  is the normality or the percentage composition of the solution, and  $a, b, c, a', b',$  and  $c'$  are constants. The error is usually under 0.002. The sp. gr. of mixed solutions of sodium carbonate and hydroxide may be calculated approximately according to the law of mixtures. By applying a small correction which is a linear function of the temperature, formulæ are obtained from which the sp. gr. of either simple or mixed solutions of sodium carbonate and hydroxide, of not more than  $8N$  and at temperatures between  $10^\circ$  and  $80^\circ$ , may be calculated with an error of a few units in the third decimal place.  
G. Y.

**Action of Sodium Polysulphide on Sodium Hyposulphite.** ARTHUR BINZ (*Ber.*, 1905, 38, 2051—2056. Compare Abstr., 1904, i, 964).—When sodium hyposulphite acts on sodium polysulphide in the presence of sodium hydroxide, sulphite and sulphate are formed, whilst thiosulphite is possibly produced as an intermediate product, thus:  $\text{Na}_2\text{S}_2\text{O}_4 + \text{Na}_2\text{S}_2 + 2\text{NaOH} = \text{Na}_2\text{S}_2\text{O}_2 + \text{Na}_2\text{SO}_3 + \text{Na}_2\text{S} + \text{H}_2\text{O}$  and  $\text{Na}_2\text{S}_2\text{O}_2 + 2\text{NaOH} = \text{Na}_2\text{S} + \text{Na}_2\text{SO}_3 + \text{H}_2\text{O}$ . The action of sodium thiosulphate on sodium hyposulphite is analogous to that of sodium polysulphide, but takes place more slowly.  
A. McK.

**Action of Oxygen on Cæsium-ammonium.** ÉTIENNE RENGADÉ (*Compt. rend.*, 1905, 140, 1536—1538).—Cæsium-ammonium dissolved in liquid ammonia at  $-60^\circ$  rapidly absorbs oxygen, forming the monoxide,  $\text{Cs}_2\text{O}_2$ , as a pale red, crystalline powder which melts to a yellow liquid and solidifies on cooling to a white, crystalline mass. The oxide,  $\text{Cs}_2\text{O}_3$ , is obtained in the form of small, deep brown, lozenge-shaped crystals by the direct oxidation of the monoxide suspended in liquid ammonia, and is converted into the peroxide,  $\text{Cs}_2\text{O}_4$ , by the prolonged action of oxygen in the same medium; the peroxide forms small, yellow needles. When the oxidation of cæsium-ammonium in liquid ammonia is carried out very slowly, the cæsium monoxide reacts with the cæsium-ammonium to form cæsium hydroxide and cæsamide (compare this vol., ii, 388), and if the mixture be heated reaction



occurs between the caesamide and caesium oxide with the formation of caesium and nitrogen according to the equation  $\text{Cs}_2\text{O}_2 + \text{CsNH}_2 = 2\text{CsOH} + \text{Cs} + \text{N}$ .  
M. A. W.

**Influence of Silver Nitrate on the Solubility of Silver Nitrite.**  
ALEX. NAUMANN and ADOLF RÜCKER (*Ber.*, 1905, **38**, 2292—2295).—The experiments of Nernst (*Abstr.*, 1890, 3) on the influence of sodium acetate on the solubility of silver acetate have been repeated, and that author's results confirmed. Similar results are obtained on adding silver nitrate to a saturated aqueous solution of silver nitrite. At 18°, saturated solution contains 3.1823 grams = 0.02067 mol. of silver nitrite per litre; the following table gives the solubility of silver nitrite per litre in presence of silver nitrate :

Silver nitrate added in mol. per litre.	Silver nitrite remaining in solution.		
	Found.	Calculated.	
		According to van't Hoff.	Allowing for partial dissocia- tion of silver nitrate.
0.00258 = $\frac{1}{4} \times 0.02067$	0.01975	0.01943	0.01946
0.00517 = $\frac{1}{2} \times 0.02067$	0.01900	0.01826	0.01846
0.01033 = $\frac{1}{2} \times 0.02067$	0.01689	0.01615	0.01639
0.02067 = $1 \times 0.02067$	0.01435	0.01281	0.01335
0.04134 = $2 \times 0.02067$	0.01168	0.00843	0.00939
0.08268 = $4 \times 0.02067$	0.00961	0.00490	0.00573

As with sodium and silver acetates, the variation of the experimental from the calculated results increases with the amount of the second salt added (compare also Noyes, *Abstr.*, 1891, 142).  
G. Y.

**Dissociation of the Carbonates of the Alkaline Earths and of Magnesium Carbonate.** OTTO BRILL (*Zeit. anorg. Chem.*, 1905, **45**, 275—292).—The dissociation temperature, at which the pressure of the dissociation products is equal to one atmosphere, of calcium carbonate is 825°, and of strontium carbonate 1155°. Magnesium carbonate on heating gives a series of basic carbonates with the following formulæ and dissociation temperatures:  $10\text{MgO}, 9\text{CO}_2$ , 265°;  $9\text{MgO}, 8\text{CO}_2$ , 295°;  $8\text{MgO}, 7\text{CO}_2$ , 325°;  $7\text{MgO}, 6\text{CO}_2$ , 340°;  $6\text{MgO}, 5\text{CO}_2$ , 380°;  $5\text{MgO}, 4\text{CO}_2$ , 405°;  $7\text{MgO}, \text{CO}_2$ , 510°. Calcium, strontium, and barium may be estimated in presence of one another as follows: from 2 to 3 milligrams of the mixed precipitated carbonates (dried at 200°) are weighed in a small platinum crucible (3 mm. high) on a Nernst microbalance and heated by means of a platinum-wire electric furnace for ten minutes, first at 920° and then at 1170°. The losses of weight at these two temperatures will be the weights of  $\text{CO}_2$  corresponding

with the calcium and strontium carbonates respectively; the residue will be unchanged barium carbonate. For control, the carbon dioxide corresponding with the barium carbonate may be determined by igniting the residue with a definite weight of borax and ascertaining the loss of weight.

D. H. J.

**Monocalcium Silicate.** RUDOLF BENZIAN (*Chem. Zeit.*, 1905, 29, 737—738).—Calcium silicate, prepared by heating sand and chalk in a graphite crucible, forms hexagonal crystals, which are decomposed by water slowly at the ordinary temperature and more quickly when boiled. When calcium silicate was left in contact with water and an aqueous solution of calcium hydroxide for several weeks, it was unchanged in crystalline appearance when the crystals examined were dried at 100°. Hydration had, however, taken place, as an examination of the moist crystals showed; these underwent dehydration when dried at 100°.

A. McK.

**Magnesium Aluminium Alloys.** G. GRUBE (*Zeit. anorg. Chem.*, 1905, 45, 225—237).—A complete fusion diagram has been worked out by the method already described (this vol., ii, 320). The melting point curve consists of four branches, intersecting at the eutectic points corresponding with a temperature of 451.6° ( $\pm 1.1^\circ$ ) and 35 per cent. of magnesium and a temperature of 439.9° ( $\pm 1.1^\circ$ ) and 68 per cent. of magnesium respectively. The second and third branches intersect at a well-defined maximum point at 462.7°, indicating the existence of a compound  $\text{Al}_3\text{Mg}_4$ ; this compound forms silver-white, very brittle crystals. The alloys of magnesium, used technically under the name magnalium, contain from 5 to 30 per cent. of magnesium; their hardness increases with the percentage of magnesium. The last alloy of this group is seen from the diagram to contain 35 per cent. of magnesium. The alloys on the second branch of the curve form homogeneous conglomerates of mixed crystals which are hard and brittle but are susceptible of a very high polish and may be used for the manufacture of mirrors. Alloys with 55 to 68 per cent. of magnesium consist of crystals of the hard compound  $\text{Al}_3\text{Mg}_4$  and the soft eutectic mixture. Alloys with 68 to 100 per cent. of magnesium oxidise easily in the air.

D. H. J.

**Solubility of Lead Sulphate in Ammonium Acetate Solutions.** ARTHUR A. NOYES and WILLIAM H. WHITCOMB (*J. Amer. Chem. Soc.*, 1905, 27, 747—759).—This investigation was undertaken with the object of ascertaining the cause of the solubility of lead sulphate in ammonium acetate solutions.

Determinations of the conductivity at 25° of lead acetate solutions of concentrations between  $N/2$  and  $N/192$  have shown that lead acetate is much less ionised than are the acetates of barium, manganese, nickel, cobalt, zinc, and cadmium, and that, assuming that lead acetate dissociates into three ions, its degree of ionisation amounts to only about 22 per cent. at a concentration of  $N/10$ .

Qualitative migration experiments with saturated solutions of lead sulphate in  $N$  ammonium acetate solution are described, which lead to

the conclusion that the lead is present in the acetate solution almost entirely in the un-ionised state.

Lead sulphate is soluble to the extent of 0.636 gram per litre in 0.104*N* ammonium acetate solution at 25°, 1.38 grams per litre in 0.207*N*, and 3.06 grams per litre in 0.414*N* solution, the solubility being roughly proportional to the concentration of the ammonium acetate. Rough experiments have shown that lead sulphate has approximately the same solubility in sodium acetate solution as in an ammonium acetate solution of equivalent strength.

From the results of these experiments, it is concluded that the increased solubility of lead sulphate in acetate solutions is due mainly to the formation of un-ionised lead acetate by metathesis.

E. G.

**Colloidal Copper Oxide.** HEINRICH LEY (*Ber.*, 1905, 38, 2199—2203).—*Copper succinimide*,  $(C_4O_2NH_4)_2Cu, 6H_2O$ , obtained by decomposing mercury succinimide suspended in water with copper amalgam, forms blue leaflets or needles and melts and loses water at 160—165°. The conductivity of its aqueous solutions is small, showing that the salt is only slightly dissociated. It is, however, easily hydrolysed; its aqueous solution after a few days changes its colour from blue to dark green and brown. A precipitate of hydroxide or oxide does not, however, separate even after several weeks, but the hydrolysis is shown to be nearly complete by cryoscopic measurements. The succinimide may be removed by dialysis, but the dialysed solutions containing colloidal copper oxide are less stable than when in presence of succinimide. Electrolytes, such as chlorides or nitrates, rapidly cause a separation of gelatinous copper hydroxide from either the original or dialysed solutions.

W. A. D.

**Copper-Zinc Alloys.** OTTO SACKUR [with P. MAUZ and A. SIEMENS] (*Ber.*, 1905, 38, 2186—2196).—Curves have been plotted for various properties of all possible alloys of zinc and copper in order to ascertain at which compositions breaks occur denoting the formation of definite compounds. Thus the curve portraying the velocity of precipitation of copper from its salts shows well-marked breaks corresponding with alloys containing 41—45 per cent. and 60—62 per cent. of copper. Similarly, curves giving the rate of dissolution of alloys in acids indicate breaks at the same points. The melting-point curve shows breaks corresponding with 32.6 per cent., 49.5 per cent., and 54.6 per cent. of copper. The first of these corresponds with the alloy  $CuZn_2$ , the second with  $CuZn$ , the third with mixed crystals of  $CuZn$  and  $Cu$ .

The breaks in the curves occur with alloys containing more copper than the simple compounds  $CuZn_2$  and  $CuZn$  require. It is suggested that a dissociation equilibrium exists in the fused alloy between the compound and its components  $Cu_xZn_y \rightleftharpoons xCu + yZn$ , and that the free zinc only disappears when copper is present in a certain excess.

E. F. A.



**Anhydrous Neodymium Chloride.** CAMILLE MATIGNON (*Compt. rend.*, 1905, 140, 1637—1639. Compare Abstr., 1901, ii, 602, and this vol., ii, 391).—Neodymium chloride, unlike samarium chloride, is not attacked by hydrogen even at  $1000^{\circ}$ . Chlorine, phosphine, and aluminium phosphide have also no action on the salt. Oxygen converts it into *neodymium oxychloride*,  $\text{NdOCl}$ , which crystallises in brilliant, mauve-tinted lamellæ which have no action on polarised light and probably belong to the cubic system. The oxychloride is infusible at  $1000^{\circ}$ . Hydrogen iodide, when heated with neodymium chloride, slowly transforms it into the *iodide*,  $\text{NdI}_2$ . This is black and fuses to a black liquid, which at a higher temperature suddenly becomes transparent, apparently owing to the formation of an allotropic modification. *Neodymium bromide*, prepared by the action of hydrogen bromide on the chloride at high temperatures, closely resembles the latter in tint and crystalline form, but melts to a dark coloured liquid. Ammonia has no action on neodymium chloride at the atmospheric temperature, but forms additive compounds when heated with it. When acetylene is heated with neodymium chloride, the latter is unattacked, but the acetylene polymerises, and carbon is deposited in a form having a brilliant reflecting surface; this carbon is not graphitic. T. A. H.

**Compounds of Aluminium Chloride with Carbonyl Chloride.** E. BAUD (*Compt. rend.*, 1905, 140, 1688—1689).—Aluminium chloride dissolves in liquid carbonyl chloride, and on evaporation of the solution at the ordinary temperature a colourless liquid remains which solidifies at  $-2^{\circ}$  and has the composition  $2\text{AlCl}_3 \cdot 5\text{COCl}_2$ . Its dissociation tension is equal to 760 mm. at  $30^{\circ}$ . By removal of carbonyl chloride, the compound  $2\text{AlCl}_3 \cdot 3\text{COCl}_2$  is formed; this has a dissociation tension of 760 mm. at  $55^{\circ}$ . On further removal of carbonyl chloride, the compound  $4\text{AlCl}_3 \cdot \text{COCl}_2$  is obtained in the form of silky needles which do not decompose to an appreciable extent below  $750^{\circ}$ . The last two compounds are formed when aluminium chloride is distilled in a current of dry carbonyl chloride, and also when the vapour of aluminium chloride is led by means of a current of carbonic oxide through a red-hot tube. These two compounds are present in commercial aluminium chloride. To purify this, it should be sublimed fractionally in a current of hydrogen or nitrogen. H. M. D.

**Preparation of Binary Metallic Compounds by means of Aluminium Powder.** A. COLANI (*Compt. rend.*, 1905, 141, 33—35. Compare Matignon, Abstr., 1900, ii, 482, and Fonzes-Diacon, *ibid.*, 405).—An intimate mixture of the oxide of the metal with the non-metallic element or its oxide and finely powdered aluminium is placed in a crucible lined with magnesia and the mixture is inflamed by means of a magnesium cartridge. Where difficultly fusible products are expected, it is advantageous to add to the contents a mixture of cupric oxide or stannic oxide with aluminium powder, as these, when inflamed, produce intense heat.

Sulphides separate with difficulty from the alumina simultaneously formed. Impure specimens of manganese and iron phosphides were obtained, as also specimens of uranium arsenide and antimonide, each

containing some alumina, and of iron silicide and a mixture of iron borides.

T. A. H.

**Properties of Tin-Aluminium, Bismuth-Aluminium, and Magnesium-Aluminium Alloys.** HECTOR PÉCHEUX (*Compt. rend.*, 1905, 140, 1535—1536).—The gas evolved by the thermochemical action of recently filed alloys of aluminium with tin, bismuth, or magnesium on water (compare Abstr., 1904, ii, 487, 564, 618) consists of hydrogen only, the oxygen of the water oxidising the aluminium; 2 c.c. of the alloy  $\text{SnAl}_3$  produce 5—6 c.c. of hydrogen in 20 minutes. A solution of copper sulphate of sp. gr. 1.1 is readily decomposed by the alloys; the alloy  $\text{SnAl}_3$  evolves 5 c.c. of hydrogen in 20 minutes, the alloy  $\text{BiAl}$  three times that quantity, whilst the alloy  $\text{MgAl}$  causes a very rapid decomposition. The alloys  $\text{ZnAl}$  or  $\text{PbAl}$ , which have no action on water, decompose copper sulphate solution and slowly decompose zinc sulphate solution.

M. A. W.

**Constitution and Properties of Aluminium Steels.** LÉON GUILLET (*Compt. rend.*, 1905, 141, 35—36).—Aluminium has but little influence on the mechanical properties of steel so long as the amount present is less than 2 per cent. Up to 15 per cent., the aluminium dissolves in the iron and this solution does not dissolve carbon. The perlite in these steels is compact and granular (to this is due the brittleness of some specimens) and is not converted into martensite by tempering. When much aluminium is present, free martensite may occur even in steels containing less than 0.85 per cent. of carbon.

T. A. H.

**Reactions in the Reduction of Iron.** RUDOLF SCHENCK and W. HELLER (*Ber.*, 1905, 38, 2132—3139. Compare Schenck and Zimmermann, Abstr., 1903, ii, 423, and Baur and Glaessner, *ibid.*, 423).—When carbon monoxide is heated with metallic iron, the pressure observed after equilibrium is attained is extremely small and it appears that practically all the gas is removed. This is due to the oxidation of the iron and the deposition of the carbon in the solid form. As pure carbon monoxide cannot oxidise iron, it is assumed that the iron reacts in two distinct ways: (1) catalytically, decomposing the monoxide into carbon and the dioxide, (2) as a reducing agent on the dioxide, producing ferrous oxide and carbon monoxide. These two reactions proceed until equilibrium is established between iron, ferrous oxide, carbon, and the two oxides of carbon.

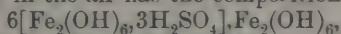
It is shown that the partial pressures of the two oxides of carbon and also the sum of these is dependent on the temperature only or that for each temperature there is a definite partial pressure for each oxide and a definite total pressure. It thus follows that in the blast furnace ferrous oxide will only be reduced by carbon monoxide in the presence of carbon if the total pressure of the monoxide and dioxide is less than the pressure of the total equilibrium. If, on the other hand, the pressure of the gas mixture at the given temperature is greater, then reoxidation of the iron occurs and deposition of carbon.

The pressures for the total equilibrium for temperatures between

400° and 800° have been determined by two methods. (1) Heating carbon monoxide with finely divided iron and measuring the pressure when equilibrium is attained. (2) Heating ferrous oxide and carbon in a vacuum and determining the pressure at fixed temperatures. The two methods give concordant results. Some of the numbers are: 468°, 10.3 mm.; 620°, 81.5 mm.; 728°, 438 mm.; and 780°, 780 mm.

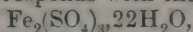
Similar experiments have been conducted with manganese, and as this is much more readily oxidised than iron the pressures are smaller: at 1200°,  $P = 10$  mm.; at 1229°,  $P = 15.3$ . The application of these principles to the metallurgy of iron in the blast furnace is discussed. J. J. S.

**Basic Ferric Sulphate.** ALBERT RECOURA (*Compt. rend.*, 1905, 140, 1634—1637. Compare Abstr., 1903, ii, 599, 600).—When ferric sulphate is dissolved in its own weight of water and the solution is shaken up with four or five times its volume of acetone and the two liquids are then allowed to remain in contact during two days, the lower aqueous layer gradually solidifies, forming a whitish-brown, voluminous, spongy mass of *basic ferric sulphate*. This is very soluble in water and when allowed to dry in the air has the composition



and when dried at 120°,  $6[\text{Fe}_2\text{O}_3, 3\text{H}_2\text{SO}_4], \text{Fe}_2\text{O}_3$ . The author considers that the sulphuric acid shown in these formulæ really exists in the salt (compare Wyrouboff, Abstr., 1902, ii, 565, 609). T. A. H.

**Hydrolysis of Concentrated Solutions of Ferric Sulphate.** ALBERT RECOURA (*Compt. rend.*, 1904, 140, 1685—1688).—When the solution obtained by dissolving anhydrous ferric sulphate in its own weight of water, which corresponds with the composition



is left in a closed vessel at the ordinary temperature for several days, a yellowish-white basic salt of the composition  $6\text{Fe}_2(\text{SO}_4)_3, \text{Fe}_2\text{O}_3$  begins to separate after about ten days. The quantity of the deposited salt gradually increases, but separation is not complete until after the expiration of several weeks. A freshly prepared solution begins to deposit the basic salt at once if a little of this is brought in contact with the solution. From a solution corresponding with the composition  $\text{Fe}_2(\text{SO}_4)_3, 15\text{H}_2\text{O}$ , the basic salt begins to separate at the end of 24 hours, whereas a solution corresponding with  $\text{Fe}_2(\text{SO}_4)_3, 28\text{H}_2\text{O}$  can be kept for years without any basic salt being deposited. The deposition is also found to be more rapid at 20° than at 0°. The author supposes that the solutions originally contain basic salt in a soluble form and that the slow deposition is largely conditioned by the gradual transformation of this into a less soluble modification. H. M. D.

**Constitution and Properties of Tin, Titanium, and Cobalt Steels.** LÉON GUILLET (*Compt. rend.*, 1905, 140, 1689—1691).—Steels containing 0.5 per cent. of tin exhibit the same structure as ordinary carbon steels. When the percentage of tin is between 5 and 10, white patches are observed surrounding the perlite. The tin apparently dissolves in the iron and separates in the form of a definite compound. The carbon is always present in the form of carbide and



there is no trace of graphite. A laminated structure is observable if more than 1 per cent. of tin is present, and such steels are extremely hard and brittle. Annealing has the same influence as on ordinary steels, and tempering only gives rise to martensite at those points where perlite previously existed.

The micrographic examination of steels containing up to 9 per cent. of titanium shows that these have the same structure as ordinary steels and the titanium appears to dissolve in the iron. The mechanical properties are in general but slightly altered, although the breaking weight of steels containing 0.7 per cent. of carbon is considerably increased by the presence of titanium. The effect of annealing and tempering is similar to that on ordinary steels.

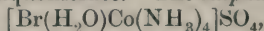
Steels containing up to 60 per cent. of cobalt show perlitic structure, and the mechanical properties are only slightly influenced by the cobalt present.

H. M. D.

**Bromo-aquotetra-ammine Cobalt Salts.** ALFRED WERNER and A. WOLBERG (*Ber.*, 1905, 38, 2009—2013. Compare this vol., ii, 322).—When  $2\text{H}_2\text{O}$  is replaced in hexa-amminecobalt salts by  $2\text{NH}_3$ , diaquotetra-ammine cobalt salts are formed (Jørgensen). The bromo-aquotetra-ammine cobalt salts now described by the authors are intermediate in structure between diaquotetra-ammine salts and dibromotetra-ammine salts, one molecule of water and one atom of bromine being directly attached to the cobalt atom. The relationship between those salts is indicated by the types  $[(\text{H}_2\text{O})_2\text{Co}(\text{NH}_3)_4]\text{Br}_3$ ,  
 $[\text{Br}(\text{H}_2\text{O})\text{Co}(\text{NH}_3)_4]\text{Br}_2$ ,

and  $[\text{Br}_2\text{Co}(\text{NH}_3)_4]\text{Br}$ .

*Bromo-aquotetra-ammine cobalt bromide*,  $[\text{Br}(\text{H}_2\text{O})\text{Co}(\text{NH}_3)_4]\text{Br}_2$ , prepared by warming dibromotetra-ammine cobalt bromide with water and a little hydrobromic acid, forms brownish-violet prisms, the solution of which in cold water is violet and in warm water pink. The corresponding *chloride* forms violet prisms, the solution of which in water is violet. It crystallises with  $\frac{1}{2}\text{H}_2\text{O}$ . The *nitrate*,  $[\text{Br}(\text{H}_2\text{O})\text{Co}(\text{NH}_3)_4]\text{NO}_3$ , prepared by digesting the bromide with a mixture of nitric acid and water, forms reddish-violet crystals; in aqueous solution, it is quickly transformed into the diaquonitrate. The *sulphate*,



separates as violet crystals from a solution of dibromotetra-ammine cobalt sulphate in warm water on the addition of a mixture of alcohol and ether. It may also be prepared by the addition of a mixture of sulphuric acid and alcohol to an aqueous solution of the bromo-aquotetra-ammine bromide.

A. McK.

**Alloys of Nickel and of Cobalt with Iron.** W. GUERTLER and GUSTAV TAMMANN (*Zeit. anorg. Chem.*, 1905, 45, 205—224).—The freezing point curves for both nickel and cobalt steels and the curves of magnetic transformation for cobalt steels have been determined and complete equilibrium diagrams constructed. The cobalt and nickel steels have also been examined microscopically. A *résumé* of the properties of the alloys of the iron group is given.

The freezing point curve of nickel-iron alloys consists of two branches, of which one, extending from 100 to 35 per cent. of nickel,

exhibits a well-marked minimum. The freezing point curve of cobalt-iron mixtures also consists of two branches, of which one, extending from 100 to 5 per cent. of cobalt, is at the same level as the melting point of cobalt; an addition of iron has no appreciable influence on the melting point of cobalt. During the crystallisation of all these alloys, the crystals have the same composition as the mother liquor.

The mixed crystals of Co—Ni, Co—Fe, and Ni—Fe, which separate from fused masses, are non-magnetic. On cooling, they are transformed into other magnetic varieties of crystals. The curves which express the dependence of the transformation temperature on the composition of the mixed crystals are discontinuous except in the case of the Co—Ni crystals; on the transformation curve for the Ni—Fe crystals there is one break, and on the curve for the Co—Fe crystals three breaks. Hence nickel and cobalt must be considered as isomorphous at temperatures both above and below the transformation curves; two series (magnetic and non-magnetic) of nickel-iron mixtures exist, namely, from 100 to 35 per cent. and from 35 to 0 per cent. of nickel. Two series of non-magnetic Co—Fe crystals and four series of magnetic crystals may be prepared. During the transformation of non-magnetic mixed crystals there does not appear to be any change in the composition of the crystals, except in the case of cobalt-iron crystals containing 80 to 60 per cent. of cobalt.

D. H. J.

**Constitution of Complex Salts. I. Derivatives of the Sesquioxides.** ALEXANDER T. CAMERON (*Proc. Roy. Soc. Edin.*, 1905, 25, 722—737).—The formulæ assigned to the chromoxalates by previous investigators is discussed. It has been stated by Werner (*Trans.*, 1887, 51, 383; 1888, 53, 404) that definite compounds exist corresponding with the formulæ  $K_5NH_4Cr_2(C_2O_4)_6 \cdot 6H_2O$  and  $KNH_4Cr_2(C_2O_4)_4 \cdot 10H_2O$ , and on this ground doubled formulæ were assigned by him to the alkali chromoxalates.

In order to determine whether the blue complex salt corresponding with the first type is a definite compound or an isomorphous mixture of the potassium and ammonium salts, the author prepared a series of blue chromoxalates by crystallisation of solutions containing potassium dichromate, potassium and ammonium hydrogen oxalates, and oxalic acid in different proportions. The percentage of ammonia and the sp. gr. of the crystals was determined. On plotting the specific volume against the percentage of ammonia, a straight line is obtained, which result supports the view that the potassium ammonium chromoxalates are isomorphous mixtures. For some unexplained reason, the specific volume of the pure potassium salt does not fall on the straight line passing through the specific volumes of the mixtures.

In the second part of the paper, the constitution of complex salts of dibasic acids of the type  $H_2X$  and of metals forming oxides of the type  $M_2O_3$  is considered. The complex chromoxalates are taken as examples, these being regarded as derivatives of chromic hydroxide in which the hydroxyl groups are substituted by half-saturated oxalate groups. Three chief types, A, B, and C, are distinguished according as three, two, or one hydroxyl group is replaced.

A1,  $\text{Cr}(\text{C}_2\text{O}_4\text{K})_3$ ; A2,  $\text{C}_2\text{O}_4[\text{Cr}(\text{C}_2\text{O}_4\text{K})_2]_2$ ;

B1,  $\text{OH}\cdot\text{Cr}(\text{C}_2\text{O}_4\text{K})_2$ , or by loss of water  $\text{O}[\text{Cr}(\text{C}_2\text{O}_4\text{K})_2]_2$ ;

B2,  $\text{HO}\cdot\text{Cr}(\text{C}_2\text{O}_4\text{K})\cdot\text{C}_2\text{O}_4\text{H}$ , or by loss of water  $\text{C}_2\text{O}_4\cdot\text{Cr}\cdot\text{C}_2\text{O}_4\text{K}$ ;

B3,  $\text{C}_2\text{O}_4[\text{Cr}(\text{OH})\cdot\text{C}_2\text{O}_4\text{K}]_2$ ;

C,  $\text{Cr}(\text{OH})_2\cdot\text{C}_2\text{O}_4\text{K}$ , or by loss of water  $\text{O}\cdot\text{Cr}\cdot\text{C}_2\text{O}_4\text{K}$ .

The types A2 and B3 result by elimination of one molecule of potassium oxalate from two molecules of A1 and B1 respectively.

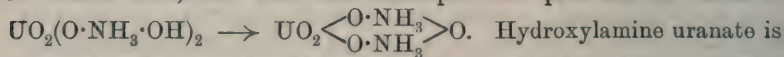
The author shows that nearly all the complex derivatives of the sesquioxides can be referred to one or other of these types, and that monobasic acids can replace the dibasic acids without alteration of the type. A table is given in which the complex compounds yielded by the sesquioxide-forming elements, vanadium, chromium, manganese, iron, cobalt, aluminium, thallium, arsenic, antimony, and bismuth, with hydrochloric, hydrofluoric, hydrocyanic, thiocyanic, nitrous, sulphuric, oxalic, and tartaric acids, are represented according to the above types.

In a similar manner, it is shown that the complex chlorides, fluorides, sulphates, and oxalates of the quadrivalent metals tin, thorium, titanium, and uranium can be represented as derived from the metallic hydroxides according to types in which four, three, and two hydroxyl groups respectively are substituted.

Certain compounds cannot be represented according to the types enumerated. Such are the aluminium oxalates prepared by Rosenheim and Cohn (Abstr., 1896, i, 278), which correspond with the formula  $\text{OH}\cdot\text{Al}_2(\text{C}_2\text{O}_4\text{M})_5$ , and the amorphous sulphochromosulphates of Recoura (Abstr., 1899, ii, 226).

H. M. D.

**So-called Solid Solutions of Indifferent Gases in Uranium Oxides.** CARL FRIEDHEIM (*Ber.*, 1905, 38, 2352—2359. Compare Kohlschütter and Vogdt, this vol., ii, 394).—It is suggested that the product obtained by heating hydroxylamine uranate at  $125^\circ$  is not a solid solution of nitrogen and nitrous oxide in uranic acid, but that the decomposition proceeds as follows:



Hydroxylamine uranate is known to behave as an acid, and the compound obtained by the action of heat may be regarded as an anhydride, so that the residue after heating consists of this anhydride mixed with a certain amount of uranic acid. The action of acids ( $\text{H}_2\text{SO}_4$ ) on the anhydride is to yield uranyl sulphate and  $(\text{HO}\cdot\text{NH}_3)_2\text{O}$ . This latter loses water, yielding the anhydride of hydroxylamine,  $(\text{NH}_2)_2\text{O}$ , which immediately decomposes into nitrogen, nitrous oxide, ammonia, hydrogen, and water. Kohlschütter and Vogdt state that hydrogen is not evolved; it is probably used up in reducing the uranium trioxide. The amounts of nitrogen, nitrous oxide, and ammonia agree roughly with those required by above reactions.

J. J. S.

**Lithium Uranyl Sulphate and Magnesium Uranyl Sulphate.** WILLIAM OECHSNER DE CONINCK and CHAUVENET (*Bull. Acad. roy. Belg.*, 1905, 151—152, 182).—*Lithium uranyl sulphate*, prepared by crystallisation from aqueous solutions containing molecular proportions of the two sulphates, has the formula  $\text{Li}_2\text{SO}_4\cdot\text{UO}_2\text{SO}_4\cdot 4\text{H}_2\text{O}$ , and closely



resembles the analogous salts already described (this vol., ii, 254, 394, 398).

By an analogous method, a *magnesium uranyl sulphate* of the formula  $\text{MgSO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 5\text{H}_2\text{O}$  was prepared.

T. A. H.

**Zirconium Sulphates.** OTTO HAUSER (*Zeit. anorg. Chem.*, 1905, 45, 185—204).—Normal anhydrous zirconium sulphate,  $\text{Zr}(\text{SO}_4)_2$ , is dissolved in large quantity by water; the solution is accompanied by great development of heat, due chiefly to the formation of the hydrated salt,  $\text{Zr}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ . Sufficiently concentrated solutions can be preserved unchanged, but at a certain degree of dilution there is a separation of the basic salt,  $4\text{ZrO}_3 \cdot 3\text{SO}_3 \cdot 14\text{H}_2\text{O}$ . The dilution required to produce precipitation of the basic salt increases with rising temperature. The velocity of the reaction is very small, and diminishes rapidly with fall of temperature. Temperatures in the neighbourhood of  $40^\circ$  are best suited to the study of the reaction.

D. H. J.

**Preparation and Properties of Thorium Chloride and Bromide.** HENRI MOISSAN and MARTINSEN (*Compt. rend.*, 1905, 140, 1510—1515. Compare Berzelius, *Ann. Phys. Chem.*, 1829, 16, 385; Chydenius, *Annalen*, 1863, 127, 33; Troost, *Abstr.*, 1885, 1113; Krüss and Nilson, *Abstr.*, 1887, 704; Moissan and Étard, *Abstr.*, 1896, ii, 422; Matignon and Delépine, *Abstr.*, 1902, ii, 106).—The authors have prepared thorium chloride,  $\text{ThCl}_4$ , in the form of colourless crystals by the action of chlorine on thorium carbide at a high temperature, but although the reaction was conducted in a special apparatus free from air and moisture, the product contained traces of the oxychloride due to the action of the thorium chloride on the porcelain tubes. Thorium chloride is only feebly radioactive, dissolves readily in water, and from the saturated solution crystals of the hydrate,  $\text{ThCl}_4 \cdot 8\text{H}_2\text{O}$ , are obtained (compare Cleve, *Abstr.*, 1874, 234); it is soluble also in alcohol or aqueous ether, but insoluble in benzene, toluene, turpentine, chloroform, or carbon disulphide, has a sp. gr. 4.59, sublimes at  $720\text{--}750^\circ$ , and melts at  $820^\circ$ . Thorium chloride is readily decomposed by fluorine, yields the oxide when heated to redness in a current of oxygen, a mixture of the sulphide and oxysulphide when heated in a current of sulphur vapour and hydrogen, the selenide and phosphide being similarly obtained. By the action of liquid ammonia (Matthews, *Abstr.*, 1890, 295), it is converted into a sparingly soluble ammoniacal thorium chloride. Thorium bromide (Troost and Ouvrard, *Ann. chim. phys.*, 1889, [vi], 17, 227), prepared in the form of transparent crystals by the action of bromine vapour on the flux obtained by fusing a mixture of thoria and carbon in the electric furnace, is unstable in the light, has a sp. gr. 5.62, that of the fused salt being 5.67, sublimes at  $710^\circ$ , and boils at  $725^\circ$ ; it dissolves in water to form the hydrate,  $\text{ThBr}_4 \cdot 8\text{H}_2\text{O}$ , from which the oxybromide,  $\text{ThOBr}_2$ , is obtained by boiling with water in the presence of air, and subsequently drying at  $160^\circ$ ; it behaves similarly to the chloride towards oxygen, sulphur, selenium, phosphorus, or liquid ammonia.

M. A. W.

**So-called Explosive Antimony.** III. ERNST COHEN and TH. STRENGERS (*Zeit. physikal. Chem.*, 1905, 52, 129—170. Compare Abstr., 1904, ii, 345; this vol., ii, 170).—The authors have determined the heat produced by acting on a known weight of (1) ordinary antimony, (2) non-explosive electrolytic antimony, (3) explosive antimony, or (4) exploded antimony, with a carbon disulphide solution of bromine. The results show that explosive antimony is to be regarded as a solid solution of antimony trichloride, tribromide, or tri-iodide in a metastable form of the metal, referred to as  $\alpha$ -antimony. The explosion is the transformation of this  $\alpha$ -antimony into ordinary antimony, and the heat of transformation amounts to about 20 cal. per gram. Exploded antimony and non-explosive electrolytic antimony are simply solid solutions of the trichloride, tribromide, or tri-iodide in ordinary antimony. The  $\alpha$ -antimony is to be regarded as a monotropic form, for it has been observed that a solution which ordinarily deposits explosive antimony on electrolysis will deposit the stable form if the latter acts as cathode in the solution.

The foregoing interpretation furnishes an adequate explanation of the observations of earlier workers. J. C. P.

**Gold in Sea Water.** P. DE WILDE (*Arch. Sci. phys. nat.*, 1905, [iv], 19, 559—580).—The presence of gold in sea water, observed from time to time by various authors (for example, M. E. Sonstadt, *Chem. News*, 1872, 26, 159, and A. Liversidge, *J. Roy. Soc. New South Wales*, 1895, 29, 335; also *J. Soc. Chem. Ind.*, 1897, 242), is attributed to the denudation of auriferous rocks, the gold in a very fine state of division being carried by the rivers down to the sea, where it goes into solution probably as bromide or iodide. After describing the methods employed by Sonstadt and Liversidge for the extraction of gold from sea water, the author gives an account of his own process (Belgian Patent No. 156,558), which consists in treating one ton of sea water with 4 or 5 c.c. of a concentrated acid solution of stannous chloride, whereby the gold is converted into "Purple of Cassius." On the addition of half a kilo. of slaked lime, any excess of tin as well as the magnesium salts present in the water are precipitated as hydroxides, and in sinking to the bottom of the vessel carry with them all the purple of Cassius. The gold may be obtained from these hydroxides by extraction with very dilute potassium cyanide ( $\frac{1}{2}$  per mil.), and then treating the solution so obtained by one of the known methods, such as metallic zinc, &c. Sea water from the Channel and Mediterranean treated in this way was found to contain no gold, whereas water from the Atlantic and from the mother liquors of the Salin de Rassuen, near Marseilles, yielded traces of that metal. P. H.

**Alloys of Gold and Nickel.** M. LEVIN (*Zeit. anorg. Chem.*, 1905, 45, 238—242).—By Tammann's methods, a fusion diagram has been worked out for gold-nickel alloys; it gives no evidence of the existence of a definite compound. The cooling curves of alloys containing from 5—20 per cent. and from 50—70 per cent. of nickel show clearly the existence of a crystallisation interval, and with alloys containing 40 per cent. of nickel there is a eutectic horizon at a temperature of 950°.

The fact that the eutectic horizon is well marked only with alloys containing 40 per cent. of nickel, whilst the cooling curves of other alloys of the series show only a "break" at the same temperature, makes it probable that we have to do with the solidification of two series of mixed crystals rather than with a simple eutectic crystallisation of the pure metals. This is confirmed by the microscopic examination of the alloys. Alloys with from 20—90 per cent. of nickel show clearly two contiguous structural elements, of which one is easily, the other slowly, attacked by nitric acid. Alloys with from 5—10 per cent. of nickel are mostly homogeneous.

The transformation point of the nickel-gold alloys lies very near the transformation temperature ( $323^{\circ}$ ) of pure nickel, that is, the transformation temperature of nickel is independent of the percentage of gold alloyed with the nickel.

D. H. J.

**Colloidal Metals of the Platinum Series. II.** ALEXANDER GUTBIER and GUSTAV HOFMEIER (*J. pr. Chem.*, 1905, [ii], 71, 452—458. Compare this vol., ii, 396).—Colloidal rhodium can be prepared only from pure rhodium salts, as the presence of even traces of impurity prevents the formation of the hydrosol. An unstable liquid hydrosol is formed by reducing rhodium chloride in dilute solution (1 : 1000 aq.) by addition of a few drops of a very dilute solution of hydrazine hydrate (1 : 2000 aq.). In the presence of 1 per cent. of gum arabic the hydrosol is stable, can be concentrated to a certain extent over the water-bath, and on evaporation over sulphuric acid in a vacuum yields the dark brown, solid hydrosol, which contains 99.4 per cent. of rhodium and is almost completely soluble in warm water.

A stable liquid hydrosol of ruthenium hydroxide is obtained by reduction of the double salt,  $\text{Ru}_2\text{Cl}_6 \cdot 4\text{KCl}$ , by hydrazine hydrate in presence of gum arabic, whilst reduction of potassium ruthenate leads to the formation of a mixed liquid hydrosol of ruthenium and ruthenium hydroxide. The precipitate obtained from this on addition of ammonium chloride contained in one case 89.92 and in another 99.84 per cent. of ruthenium.

The liquid hydrosol of osmium, obtained by reduction of potassium osmate by hydrazine hydrate in gum arabic solution, cannot be obtained free from oxygen (compare Paal and Amberger, *Abstr.*, 1904, ii, 180); on warming with a few drops of concentrated hydrochloric acid, a metallic precipitation is obtained, but the mother liquor contains osmium chloride; the precipitate obtained on addition of ammonium chloride contained 95.44 per cent. of osmium. The solid hydrosol of osmium, obtained by evaporation over the water-bath and finally over sulphuric acid in a vacuum, is almost completely soluble in warm water.

The liquid hydrosols of rhodium, ruthenium, and osmium are decomposed when shaken with barium sulphate or with animal charcoal.

G. Y.

**Rendering Active of Hydrogen by Colloidal Palladium.** CARL PAAL and CONRAD AMBERGER (*Ber.*, 1905, 38, 2414).—In the



previous experiments (this vol., ii, 397), the hydrogen was passed through the aqueous alcoholic solution of nitrobenzene for three hours.

J. J. S.

**Halogen Derivatives of Palladium.** ALEXANDER GUTBIER and A. KRELL (*Ber.*, 1905, 38, 2385—2389. Compare Wilm, *Abstr.*, 1880, 854; Kane, *Phil. Trans.*, 1842, i, 276).—Ammonium palladichloride has the formula  $(\text{NH}_4)_2\text{PdCl}_6$ . The following new compounds have been prepared: *ammonium palladochloride*,  $(\text{NH}_4)_2\text{PdCl}_4$ , yellowish-green needles dissolving in water to a dark red solution; *cæsium palladochloride*, pale brown needles; *cæsium palladichloride*,  $\text{Cs}_2\text{PdCl}_6$ ; *rubidium palladochloride*,  $\text{Rb}_2\text{PdCl}_4$ ; *rubidium palladichloride*,  $\text{Rb}_2\text{PdCl}_6$ ; *ammonium palladobromide*, reddish-brown needles; *ammonium palladibromide*, black octahedra; *cæsium palladobromide*, reddish-brown needles; *cæsium palladibromide*, black octahedra; *rubidium palladobromide*, brownish-red needles; *rubidium palladibromide* and *potassium palladibromide*, black octahedra.

The palladous compounds crystallise from aqueous solutions, and on treatment with bromine vapour give the palladic compounds, which are sparingly soluble. All the compounds when carefully heated in a current of hydrogen yield metallic palladium.

J. J. S.

**Compounds of Ruthenium with Oxygen.** ALEXANDER GUTBIER and F. RANSOHOFF (*Zeit. anorg. Chem.*, 1905, 45, 243—261).—The tetroxide,  $\text{RuO}_4$ , is easily obtained, but efforts to obtain by Claus' method ruthenium monoxide,  $\text{RuO}$ , or his sesquioxide,  $\text{Ru}_2\text{O}_3$ , in a pure condition failed, as did likewise attempts to prepare Joly's hydroxide,  $\text{Ru}(\text{OH})_4 \cdot 3\text{H}_2\text{O}$ , and Debray and Joly's oxides,  $\text{Ru}_2\text{O}_5$  and  $\text{Ru}_4\text{O}_9$ . Finely divided ruthenium when heated in the air takes up about 27 per cent. of oxygen and yields apparently a mixture of ruthenium dioxide and ruthenium. By adding potassium hydroxide to a solution of ruthenium sesquichloride, ruthenium sesquihydroxide,  $\text{Ru}_2(\text{OH})_6$ , is thrown down as a finely divided, dark brown, amorphous precipitate which can be dried over sulphuric acid, and when heated gives ruthenium sesquioxide,  $\text{Ru}_2\text{O}_3$ , as an intermediate product. The precipitate formed by neutralising an alkali ruthenate with nitric acid is neither pure  $\text{Ru}_2(\text{OH})_6$ , as assumed by Claus, nor  $\text{Ru}_2\text{O}_5 \cdot 2\text{H}_2\text{O}$ , as assumed by Debray and Joly, but a mixture of ruthenium sesquihydroxide with another anhydrous oxide. A mixed product is also obtained by reducing an alkali ruthenate with alcohol. Ruthenium dioxide,  $\text{RuO}_2$ , sublimes in small quantity on heating ruthenium in a stream of oxygen and is obtained quantitatively in the form of blue plates easily reducible by hydrogen by igniting ruthenium sulphate till the weight is constant.

D. H. J.

## Mineralogical Chemistry.

**The Natural Iron-nickel Alloy, Awaruite.** GEORGE S. JAMIESON (*Amer. J. Sci.*, 1905, [iv], 19, 413—415).—Thin sections of water-worn pebbles of "josephinite," from Josephine Co., Oregon, showed that the alloy is of a spongy nature, binding together and enclosing particles of serpentine. Deducting 24.15 per cent. of insoluble silicate, the composition of the alloy is given under I. Analysis II is of a similar alloy from Smith River, Del Norte Co., California; this is a metallic sand with the grains of very uniform size (0.15 mm. diam.), obtained from gold-washings; mixed with it are magnetite and a very little chromite (9.45 per cent. deducted from the analysis).

	Fe.	Ni.	Co.	Cu.	P.	S.	Sp. gr.
I.	25.24	74.17	0.46	—	0.04	0.09	—
II.	21.45	76.60	1.19	0.66	0.04	0.06	7.85
III.	31.02	67.63	0.70	nil	("Awaruite," New Zealand; W. Skey, 1885.)		
IV.	26.60	/ 75.20		nil	(Piedmont; A. Sella, 1891.)		
V.	27.41	71.35	0.65	0.59	("Josephinite," Oregon; W. H. Melville, 1892.)		
VI.	22.30	76.48	nil	1.22	("Souesite," British Columbia; G. C. Hoffman, this vol., ii, 328.)		

Previous analyses of terrestrial iron-nickel alloys are quoted above under III—VI; these are seen to have a certain uniformity in composition, though there seems to be no definite compound of iron and nickel ( $\text{FeNi}_3$  corresponds with Fe 24.0, Ni 76.0, and  $\text{FeNi}_2$  with Fe 32.2, Ni 67.8 per cent.). The use of several distinct names is thus superfluous, and it is suggested that the earliest name, awaruite, should alone be used. The occurrence of the alloy with serpentine and chromite suggests that it has separated from a basic peridotite magma, and the fact that it is found as a heavy constituent in river sands shows that it is little liable to alteration by oxidation.

L. J. S.

**Presence of Chromium and Vanadium in Coal from Liège.** ARMAND JORISSEN (*Bull. Acad. roy. Belg.*, 1905, 178—181).—In addition to the elements already observed in the soot produced by the combustion of coal from the deposits in the neighbourhood of Liège (*Abstr.*, 1897, ii, 265, and 1903, ii, 149), the author has now found chromium and vanadium. These elements also occur in the shales associated with this coal, and may be detected by the same methods in the red ash left on complete combustion of these.

T. A. H.

**Minerals [Tengerite? &c.] from Llano County, Texas.** WILLIAM E. HIDDEN (*Amer. J. Sci.*, 1905, [iv], 19, 425—433).—The quarry at the noted gadolinite locality on "Barringer Hill," in Llano Co., has recently been opened up again for the purpose of obtaining a supply of minerals rich in yttrium and erbium, which are used in the construction of the Nernst lamp. Masses of gadolinite

and allanite of over 300 pounds weight and an eighteen-pound mass of yttrialite were found, also enormous crystals, over four feet across, of quartz, felspar, and mica. Other minerals containing rare elements found at the locality include nivenite, mackintoshite, thoro-gummite, fergusonite, cyrtolite, and rowlandite; a preliminary account of the radioactive properties of these is given. A white mineral occurring in small amount as semiglobular or flattened concretions in cracks and fissures in the gadolinite was analysed by W. F. Hillebrand with the following results, from which it appears that the substance may be tengerite, or possibly tengerite mixed with a new beryllium mineral; the occurrence of beryllium as carbonate is new.

Y <sub>2</sub> O <sub>3</sub> group (mol. wt.	Ce <sub>2</sub> O <sub>3</sub> group (mol. wt.				H <sub>2</sub> O ( >105°).	H <sub>2</sub> O ( <105°).	SiO <sub>2</sub> .	MgO, Alk. loss.	Total.
226).	335).	Fe <sub>2</sub> O <sub>3</sub> .	BeO.	CO <sub>2</sub> .					
40.8	7.0	4.0	9.7	19.6	14.1	3.2	0.4	1.2	100.0

L. J. S.

**Occurrence of Redonda Phosphate in Martinique.** ALFRED LACROIX (*Chem. Centr.*, 1905, i, 1613; from *Bull. Soc. franç. Min.*, 28, 13—16).—The andesite conglomerate which occurs in the island of La Perle, on the N.E. coast of Martinique, is covered with a crust of brown phosphate, which is in places 7 to 8 cm. thick. The zonal structure of the andesite still remains, but the magnetite has completely disappeared. Analysis of the phosphate by Arsandaux gave:

Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	P <sub>2</sub> O <sub>5</sub> .	H <sub>2</sub> O.
34.20	trace	trace	41.20	24.50

The formation of the same phosphate from different minerals is remarkable. In Martinique, it is a decomposition product of hypersthene-andesite; at Chipperton, a product of trachyte; at Connétable, of gneiss and diabase; and at Redonda, of corallite. E. W. W.

**Janosite, a New Hydrated Normal Ferric Sulphate.** HUGO BÖCKH and KOLMAN EMSZT (*Földtani Közlöny, Budapest*, 1905, 35, 76—78, 139—142).—The new mineral occurs as a greenish-yellow, powdery efflorescence on graphitic schist in the iron mine at Vashegy, Comitát Gömör, Hungary, where it has resulted by the decomposition of iron-pyrites. Under the microscope, it is seen to consist of minute, orthorhombic plates, which have a perfect basal cleavage and distinct prismatic cleavages; the acute negative bisectrix is normal to the basal plane, and the crystals are markedly pleochroic. Hardness, 2—2½; sp. gr. 2.510—2.548. The substance is soluble in water. The following analysis agrees with the formula Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>·9H<sub>2</sub>O:

Fe.	Al.	SO <sub>4</sub> .	H <sub>2</sub> O (250°).	Total.	H <sub>2</sub> O (100°).	H <sub>2</sub> O (150°).
20.653	trace	50.715	28.503	99.871	13.519	20.081

The new mineral is thus dimorphous with the rhombohedral coquimbite; it is also near to quenstedtite, [Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>·10H<sub>2</sub>O], in composition, but differs from this in specific gravity, colour, &c. L. J. S.



**Epidote from Inverness-shire.** HERBERT HENRY THOMAS (*Min. Mag.*, 1905, 14, 109—114).—A band composed largely of epidote, together with garnet, quartz, and actinolite, occurs in gneiss near Barrisdale. The crystals of epidote are dark grey to greyish-brown in colour, and measure up to six inches in length. Complete crystallographic and optical determinations were made, together with the following analysis by W. Pollard:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	H <sub>2</sub> O.	Total.*	Sp. gr.
39·02	28·64	6·81	0·34	23·73	1·76	100·30	3·37

\* Also traces of TiO<sub>2</sub>, MnO, MgO.

In its low percentage of ferric iron, this epidote closely resembles that from Huntington, in Massachusetts, described by E. H. Forbes (*Abstr.*, 1896, ii, 371); and, as there pointed out, the refractive indices of the mineral vary with the amount of ferric iron, as shown in the following table:

	Fe <sub>2</sub> O <sub>3</sub> .	$\alpha$ .	$\beta$ .	$\gamma$ .	$\gamma - \alpha$ .	2V over $\alpha$ .
Untersulzbachthal	14·0	1·7305	1·7540	1·7677	0·0372	73°39'
Zillerthal .....	6·97	1·720	1·7245	1·7344	0·0144	87 46
Inverness-shire ...	6·81	1·714	1·7196	1·725	0·011	89 35
Huntington .....	5·67	1·714	1·716	1·724	0·010	90 32

L. J. S.

**Occurrence of Tantalum and Niobium.** JOHANNES SCHILLING (*Zeit. angew. Chem.*, 1905, 18, 883—901).—All analyses previously published of minerals containing tantalum have been collected. The sp. gr. percentage of tantalum and niobium, the localities in which the minerals occur, and references to the literature are tabulated. According to the author, large deposits of tantalum minerals are widely distributed, and as regards the extent of its occurrence in nature, there is nothing to prevent the commercial application of the metal.

H. M. D.

**Meteorites of Hvittis and Marjalahti.** LEONARD H. BORGSTROM (*Chem. Centr.*, 1905, i, 1667; from *Bull. Com. Géol. Finlande*, 1903, No. 14, 1—80).—*Hvittis*.—This meteoric stone was observed to fall at Hvittis, in Finland, on October 21, 1901; it weighed 14·05 kilos., and buried itself 50—60 cm. in the ground. The mineralogical composition is calculated from analysis I as: enstatite, 59·01; oligoclase, 9·86; nickel-iron, 21·50; oldhamite, 0·86; daubreeelite, 0·57; troilite, 7·31; nickel-iron phosphide, 0·50; chromite, 0·32. The enstatite has the composition given under II; the oligoclase (Ab<sub>4</sub>An) gave III. Graphite, glass, and an undetermined mineral are also present in small amounts. Under the microscope, the stone is seen to consist of a ground mass of crystallised silicates, embedded in which are irregularly bounded masses of sulphides and metals, as well as a few chondrules.

*Marjalahti*.—This was seen to fall at Marjalahti, in Finland, on June 1, 1902. The total weight is 44·8 kilos., and the largest mass weighs 22·7 kilos. It belongs to the pallasite type, consisting mainly of nickel-iron and olivine, together with a little troilite and

schreibersite. The nickel-iron contains : Fe, 92.28 ; Ni, 7.13 ; Co, 0.42 per cent. The olivine, which forms about 20 per cent. of the mass, has the composition given under IV ; the non-magnetic troilite contains : Fe, 63.6 ; S, 36.4 per cent. The composition of the schreibersite is given under V. It is pointed out that the phosphide,  $\text{Fe}_2\text{NiP}$ , is of the most frequent occurrence, although there may be isomorphous mixtures of  $\text{Fe}_3\text{P}$  and  $\text{Ni}_3\text{P}$ , with small amount of  $\text{Co}_3\text{P}$ .

	$\text{SiO}_2$	Fe.	FeO.	Ni.	Co	$\text{Al}_2\text{O}_3$	$\text{Cr}_2\text{O}_3$	CaO.	MgO.	$\text{K}_2\text{O}$	$\text{Na}_2\text{O}$	P.	Sp. gr.
I.	41.53	24.66	0.34	1.96	0.07	1.55	0.57	1.41	23.23	0.32	1.26	0.08*	—
II.	59.05	—	0.90	—	—	1.09	—	0.98	37.10	0.47	0.68	—	3.217
III.	63.5	—	—	—	—	22.2	—	4.0	—	1.1	9.2	—	2.60—2.65
IV.	40.26	—	11.86	—	—	—	0.12	—	47.26	0.05	0.21	—	3.38
V.	—	55.15	—	29.15	0.21	—	—	—	—	—	—	14.93	7.278

\* Also S, 3.30.

*Separation of Iron from Nickel and Cobalt by means of Formic Acid.*

—This separation is necessary in every meteorite analysis, but there is no really good method. Ammonium formate solution is prepared by adding ammonia to formic acid solution until it is neutral or only slightly acid. This is added to the neutralised iron solution and the mixture quickly brought up to boiling ; it is then transferred to a dish with hot water and kept up to the boiling point ; in a few minutes the precipitation is complete ; the precipitate is washed with hot water and is then filtered, the filtration taking place much more readily than in other methods. In the first precipitation, the iron precipitate contains only 4.35 per cent. of the nickel and cobalt, and in the second it is quite free from these elements.

L. J. S.

Italian Terrestrial Emanations. II. Gases from Vesuvius, the Flegrei Plains, the Albule Waters of Tivoli, and the Springs of Viterbo, Pergine, and Salsomaggiore. RAFFAELLO NASINI, FRANCESCO ANDERLINI, and ROBERTO SALVADORI (*Memor. R. Accad. Lincei*, 1904, [v], 5, 25—82. Compare Abstr., 1896, ii, 366 ; 1898, ii, 527 ; 1899, ii, 482 ; 1900, ii, 415).—The authors give an account of their chemical and spectroscopical investigations of these various gases and describe the apparatus employed, which comprises mercury pumps automatically charging the gases into Geissler tubes, a pump for extracting and transporting the gas, arrangements for absorbing the nitrogen and burning the hydrocarbons present in the gas, and a device for distilling mercury in a vacuum. Photographs of the various spectra are given and diagrams of the different pieces of apparatus.

T. H. P.

## Physiological Chemistry.

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**Normal Alveolar Carbon Dioxide Pressure in Man.** MABEL PUREFOY FITZGERALD and JOHN S. HALDANE (*J. Physiol.*, 1905, 32, 486—494. Compare Haldane and Priestley, this vol., ii, 400).—It was shown previously that whilst the normal alveolar pressure of carbon dioxide remained constant in the same person, it varied in the two individuals experimented on. It being of interest to ascertain the limits in different people, a large number of observations were made, and the results are given in tables. These are then classified and averages given for men, women, boys, and girls. The mean pressure is about 8 per cent. higher in men than in the other three groups; this may be related to the hæmoglobin, which is about 12 per cent. higher in men than in the others. There is no relationship to weight, height, respiratory capacity, or muscular work. There are slight variations occasionally seen in the same person, but no definite diurnal variations.  
W. D. H.

**Specificity of Precipitins.** ANDREW HUNTER (*J. Physiol.*, 1905, 32, 327—342. Compare Abstr., 1903, ii, 663).—The albumin, euglobulin and pseudoglobulin of ox-serum are each capable of leading to the formation of precipitins, and these are in a limited degree specific. The precipitins thus obtained are mixtures of at least four distinct anti-substances, of which albumin yields one only, whilst euglobulin and pseudoglobulin each yield three. The production of precipitins follows a wave-like course, and is accompanied by an intermittent leucocytosis, the number of leucocytes at any moment bearing an inverse relation to the amount of precipitin.  
W. D. H.

**Precipitins for Snake Venoms and Snake Sera.** ANDREW HUNTER (*Proc. Physiol. Soc.*, 1905, lxi—lxii; *J. Physiol.*, 32).—Injection of various venoms causes the appearance in the serum of specific precipitins. The haptophore groups of cobra venom and daboia venom are thus shown to be very different. The precipitin reaction cannot be used to standardise venoms and antivenoms, for the precipitability of any venom by its antivenom is quite independent of its toxicity.  
W. D. H.

**Pigmentation and Intravascular Coagulation.** GEORGE P. MUDGE (*Proc. Physiol. Soc.*, 1905, lxxviii; *J. Physiol.*, 32).—Nucleo-proteid was prepared from rabbits' testes. A larger dose is required to kill albino rabbits than pigmented animals, whether the nucleo-proteid was obtained from albino or pigmented animals. In a certain proportion of cases, intravascular coagulation failed to occur in albinos when injected with a nucleo-proteid derived from pigmented animals, although the injection produced death from some other cause (confirmatory of Halliburton and Brodie, *J. Physiol.*, 1894, 17, 135—173; Abstr., 1894,



ii, 463; Pickering, *J. Physiol.*, 1896, 20, 310—315; Abstr., 1896, ii, 664).  
W. D. H.

**Changes in Viscosity of Blood during Narcosis.** RUSSELL BURTON-OPITZ (*J. Physiol.*, 1905, 32, 385—389. Compare this vol., ii, 98).—Dogs were anæsthetised with morphine in conjunction with either ether or chloroform. The viscosity of the blood is increased by deep and lessened by light narcosis. The differences found with moderate narcosis are too slight to be of any practical importance. With ether, the specific gravity varies with the viscosity; with chloroform, an inverse relationship exists.  
W. D. H.

**Gaseous Metabolism of Rabbits' Small Intestine.** A. E. BOYCOTT (*J. Physiol.*, 1905, 32, 343—357).—Oxygen disappears from the intestine partly by diffusion, but mainly by being used up by the mucous membrane. There is very little direct exchange with the blood. It is usually present in the small intestine. The intestinal wall is very permeable to carbon dioxide. In the rabbit the permeability is so great that the tension of the gas within the intestine is nearly the same as that outside. The nitrogen of air introduced into the intestine undergoes very little change in five hours; there is a small, but doubtful, loss by diffusion. The combustible constituents of the intestinal gas are of a complex and partly unknown nature; they may enter the lumen of the gut from the blood. An appendix gives some analyses made of the gases found naturally in the intestine of cats and dogs; carbon dioxide, oxygen, nitrogen, hydrogen, and methane were present.  
W. D. H.

**Carbohydrate Metabolism in Partially Depancreated Dogs.** PERCY W. COBB (*Amer. J. Physiol.*, 1905, 14, 12—15).—The experiments were in some cases followed by glycosuria; in some cases, duodenal abscesses were found *post mortem*. The dextrose-nitrogen ratio was high. The sugar from endogenous proteids appears to be more readily oxidised by the tissues than is that derived from exogenous proteids. Lüthje (*Münch. med. Woch.*, 1903, 50, 1539) takes the same view.  
W. D. H.

**Animal Lactase.** CH. PORCHER (*Compt. rend.*, 1905, 140, 1406—1408).—A good agent for extracting lactase from the intestinal mucous membrane of freshly killed kids was found to be ether saturated with water.  
W. D. H.

**Amylolytic Action of Urine.** GEORGE H. CLARK (*Glasgow Med. J.*, 1905, June).—The amylolytic enzyme in urine, which has been described by several previous observers, is precipitable by alcohol and is soluble in glycerol. It was not found in five cases of diabetic urine.  
W. D. H.

**The Specificity of Certain Digestive Ferments.** K. KIESEL (*Pflüger's Archiv*, 1905, 108, 343—368).—The proteolytic and rennetic ferments of the dog and cow show some specificity in relation to the

caseinogen yielded by the two animals respectively. Trypsin and pancreatic rennet are exceptions to this rule, and show a constant greater affinity for the caseinogen of the cow. Differences between the caseinogen of various animals have long been known. It now appears that there are molecular differences in the ferments which attack it. The specificity of the gastric ferments emphasises the importance of feeding young animals on the milk of their mothers. Cow caseinogen by heating to  $90^{\circ}$  becomes partly insoluble in alkalis; this does not occur in the case of dog's milk, but the caseinogen of this animal after such treatment unites with more alkali. The time law for pancreatic rennet is the same as that described by Segelcke and Storch for gastric rennin.

W. D. H.

**Action of Trypsin.** SVEN G. HEDIN (*J. Physiol.*, 1905, 32, 465—485).—The time of digestion varies inversely with the amount of trypsin, provided the substrate (various proteids were tried) is present in sufficient quantity.

W. D. H.

**Antitryptic Action of Serum Albumin.** SVEN G. HEDIN (*J. Physiol.*, 1905, 32, 390—394).—The antitryptic action of serum has been shown to be connected with the albumin fraction. If trypsin and antitrypsin are added separately to the substrate (casein), the order in which they are added is a matter of indifference. If they are mixed before they are added, then the neutralising effect of the antitrypsin is greater than if they are added separately. The longer the mixture is kept before it is added to the substrate, the greater up to a certain point is the amount of trypsin neutralised, especially at high temperatures ( $37^{\circ}$ ). Trypsin neutralised at such a temperature is not even partly activated on lowering the temperature.

W. D. H.

**Glycolytic Principle in Blood-Fibrin.** NADINE SIEBER (*Zeit. physiol. Chem.*, 1905, 44, 560—579).—The occurrence of glycolysis depends on a high relative proportion between the active principle and the sugar acted on. Bacterial action can be excluded.

W. D. H.

**Localisation of Ferments in the Hen's Egg.** JULIUS WOHLGEMUTH (*Zeit. physiol. Chem.*, 1905, 44, 540—545).—By the autolytic method, ferments were found to be absent in the white; but in the yolk, ferments able to decompose proteid, lecithin, and fat are present.

W. D. H.

**Hours of Sleep in Public Schools.** THEODORE DYKE ACLAND (*Lancet*, 1905, ii, 136—142).—A plea on physiological grounds for longer hours of sleep than are allowed by traditional rules in English public schools. Metabolism is relatively more active in growing persons, and so more rest is necessary. Growing chiefly occurs during sleeping hours. In some schools in America the necessity for about ten hours of sleep for boys seems to have been already recognised.

W. D. H.

**Chemistry of Flesh.** II. HARRY S. GRINDLEY and A. D. EMMETT (*J. Amer. Chem. Soc.*, 1905, 27, 658—678. Compare Abstr., 1904, ii, 829).—The paper treats mainly of methods. The examination of cold-water extracts (in raw meat, from a fourth to a third of the total solids is soluble in this reagent) gives a truer notion of the composition of flesh than the older methods do. The proteids differ in character and quantity in different meats; among them albumose is present. A point is made of the high percentage of extractives: in beef this is from 1 to 1.7 for nitrogenous, and from 1.4 to 2.2 for non-nitrogenous extractives. The differences between raw and cooked meats are emphasised. The paper contains numerous analytical tables.

W. D. H.

**Heat Value of Nervous and Muscular Tissues in Guinea Pigs of Different Age.** J. TRIBOT (*Compt. rend.*, 1905, 140, 1565—1566).—The amount of fatty matter reaches its maximum in the guinea pig on the 120th day after birth in the nervous tissues, and on the 180th day in the muscles; the proteid matter reaches a minimum on the same dates. The net result is an increased calorific value of the material at the same times.

W. D. H.

**So-called Normal Arsenic.** ADAM J. KUNKEL (*Zeit. physiol. Chem.*, 1905, 44, 511—529).—Gautier's statement that arsenic must be regarded as a normal constituent of animal tissues and organs is questioned. In the present research it was never found in any organs, even in the thyroid, to which Gautier attaches special importance. Much of the present paper relates to methods of analysis.

W. D. H.

**An Instrument for recording Ciliary Activity.** WALTER E. DIXON and O. INCHLEY (*J. Physiol.*, 1905, 32, 395—400).—The instrument, which is described and figured, is called the cilioscribe. The ciliary activity ultimately rotates a drum on which a time tracing is taken; the comparative rate of ciliary action is thus known. Details of the best saline fluids to use to moisten the ciliated surface are given. The instrument can be used to study the effect of temperature, drugs, &c., on ciliary movement.

W. D. H.

**Reversal of the Effective Stroke of Cilia.** G. H. PARKER (*Amer. J. Physiol.*, 1905, 14, 1—6. Compare this vol., ii, 183).—Revision of previous conclusions is rendered necessary by the following new observations: reversal of the effective stroke in the labial cilia of sea anemones is produced by creatine, but not by creatinine or uric acid. It is probable that creatine is an effective element when fish meat is applied to the lips of these animals. No reversal is obtained with sucrose, dextrose, lactose, or maltose, but it is produced by Witte's peptone, deutero-albumose, and aspartic acid. In all instances reversal is not accompanied by discharge of nettle capsules or slime, and so resembles what occurs in normal feeding. The reversal in normal feeding is now held to be due to organic molecules, and not to ion action, although potassium ions in sufficient concentration will cause reversal.

W. D. H.



**The Behaviour of Stereoisomerides in the Animal Organism. II. Inactive Amino-acids.** JULIUS WOHLGEMUTH (*Ber.*, 1905, 38, 2064—2065. Compare Abstr., 1902, ii, 336).—If an externally compensated amino-acid is given to rabbits by the mouth, subcutaneously, or intravenously, the component which occurs in the animal is digested to its assimilation limit, whilst the other is excreted completely or almost completely in the urine. The excreted tyrosine from 8 grams of *i*-tyrosine given by the mouth consisted of 75 per cent. of the *d*- and 25 of the *l*-amino-acid; of 10 grams of *i*-leucine and of 6 grams of *i*-asparagine, only the *d*-amino-acids, and from 5.5 grams of *i*-glutamic acid only the *l*-component, reappeared in the urine.  
G. Y.

**Fate of Glyoxylic Acid in the Animal Organism.** HANS EPPINGER (*Beitr. chem. Physiol. Path.*, 1905, 6, 492—501).—Although glyoxylic acid is an important factor in plant physiology (Brunner and Chuard, *Ber.*, 1886, 19, 595; Königs, Abstr., 1892, 695; Döbner, 1901, i, 188), little is known of its behaviour in the animal system. A delicate test for glyoxylic acid is Hopkins' indole reaction in the presence of concentrated sulphuric acid, when a red ring is obtained which gradually spreads upwards through the liquid. The red compound can be extracted with amyl alcohol.

No ordinary compounds give this reaction except condensation products of glyoxylic acid when hydrolysed. If indole is replaced by scatole, a green ring is formed.

The following products when oxidised and distilled give the test for glyoxylic acid: ethyl alcohol, lactic, tartaric, and glycollic acids, glycol, glycerol, betaine, and sarcosine. Methyl alcohol, acetone, carbamide, and formic and oxalic acids do not appear to yield glyoxylic acid.

In testing for glyoxylic acid in urine, it is advisable to acidify the urine with phosphoric acid, to distil, and to test the distillate by means of the indole or scatole reaction. Crude urine does not give the latter reaction.

The urine of many animals gives the indole test, but occasionally negative results are obtained; the differences are probably due to divergencies in feeding, although the introduction of calcium glyoxylate into the food does not increase the amount of glyoxylic acid in the urine. The administration of considerable amounts of alcohol (10—15 c.c.) increases the glyoxylic acid to a large extent, and to a less extent the administration of glycine, glycollic acid, betaine, and sarcosine.

When glyoxylic acid is given to dogs, a considerable increase in the oxalic acid and allantoin contained in the urine is observed.

J. J. S.

**Influence of Fruit on the Precipitation of the Uric Acid of the Urine.** WILLIAM J. SMITH JEROME (*Lancet*, 1905, ii, 142—147).—Pears, grapes, figs, oranges, and dates may be taken not only with impunity but with advantage by those who suffer from calculus and gravel. The good effect is due to the lessened acidity of the urine.

W. D. H.

**Experimental Glycosuria.** JOHN J. R. MACLEOD and J. DOLLEY (*Proc. Physiol. Soc.*, 1905, lxiii—lxiv; *J. Physiol.*, 32).—Eckhard found that puncture of the medulla oblongata did not cause glycosuria when the splanchnic nerves were cut, and so argued that the impulses reached the liver by these nerves. Glycosuria does not follow stimulation of the peripheral end of the cut nerves, but it does occur if the cervical part of the spinal cord is stimulated; hence the impulse is considered to undergo some change as it passes through the upper sympathetic ganglia. In the present research, nicotine was injected to block the ganglia; puncture then produces little or no glycosuria, and glycogen did not disappear from the liver. Stimulation of the central end of the vagus produces glycosuria, whether nicotine has been injected or not. Application of nicotine locally to the stellate ganglia during excitation of the vagus renders the urine sugar-free. It also causes a lowering of blood pressure, and that in itself causes the sugar to disappear.

W. D. H.

**Metabolism in Cystinuria.** CARL ALSBERG and OTTO FOLIN (*Amer. J. Physiol.*, 1905, 14, 54—72).—The experiments recorded in connection with a case of cystinuria do not corroborate the views of Loewi and Neuberg (this vol., ii, 103) on this subject. With a standard (Voit) diet of milk and egg, the neutral sulphur, including the cystine sulphur of the urine, was about five times as great as the normal; this is produced chiefly or wholly by the presence of cystine, and occurs at the expense of the inorganic sulphates; the ethereal sulphates occur in normal proportions. This is accompanied by a fall in ammonia to about half the normal quantity, and a reduction of about 4 per cent. in the urea nitrogen. The elimination of uric acid and creatinine is normal. The "undetermined" nitrogen is increased. It appeared probable, therefore, that amino-acids might account for this, and that Loewi and Neuberg's generalisations on the nature of the disease were correct. This interpretation was shattered by the results obtained when a fat and starch diet was substituted for the one first used, for the undetermined nitrogen remained stationary. If aspartic acid was added to the nitrogen-free diet, the nitrogen excreted rose to an amount beyond that which the aspartic acid would account for, and the increase is due to urea and not to undetermined nitrogen; the patient was therefore able to convert the nitrogen of aspartic acid into urea. If pure cystine prepared from hair was added instead, the neutral sulphur elimination was not increased; that is to say, in so far as cystine is absorbed it is not excreted as such, but as ordinary sulphates. There is thus no inability to katabolise normally the usual products of proteolysis. There is less neutral sulphur excreted when the diet contains little or no proteid; patients suffering from cystinuria should therefore keep their proteid intake at a minimum. The cystine which is eliminated is not absorbed as such from the alimentary tract; that comes from other or larger sulphur complexes; it is this and the sulphur from the tissues which the cystinuric person is unable to convert into sulphates. No support is given to the view that calculus-cystine differs structurally from proteid-cystine (compare Rothera, this vol., ii, 267).

W. D. H.

**Migration of Potassium and the Injury Current.** J. S. MACDONALD (*Proc. Physiol. Soc.*, 1905, lxi—lxvii; *J. Physiol.*, 32).—At an injured spot of the axis cylinder there is a granular appearance, the granules being stainable with neutral-red; Macallum's reagent shows a dense precipitate of potassium salts at the same spot. Injury probably causes a precipitation of proteid matter and a liberation of potassium salts in a state of simple aqueous solution. A new theory of nerve-conduction is founded on this and related facts.

W. D. H.

**Photo-electrical Effects in Frog's Eyeball.** AUGUSTUS D. WALLER (*Proc. Physiol. Soc.*, 1905, lxi; *J. Physiol.*, 32).—Certain facts show that the photo-electrical effects are more probably pigmentary than retino-motor. The response is increased by tetanisation up to a certain strength, and even very strong tetanisation does not abolish the photo-electrical response, though it abolishes the "blaze-reaction."

W. D. H.

**Action of Salts on Skeletal and Heart Muscle.** A. E. GUENTHER (*Amer. J. Physiol.*, 1905, 14, 73—104).—A supply of sodium, calcium, and potassium ions in definite proportions is necessary to the best maintenance of the activity of skeletal and heart muscle. Sodium and potassium produce relaxation and calcium contraction when all three are present together; given alone, their effects are a little different; the order of application makes a difference also. To explain some of the complex results obtained, which are described in full, the assumption has to be made that there are two contractile substances in the sartorius, and three in the heart.

W. D. H.

**Action of Optical Isomerides. II. Hyoscines.** ARTHUR R. CUSHNY and A. ROY PEEBLES (*J. Physiol.*, 1905, 32, 501—510. Compare Abstr., 1903, ii, 564).—Hyoscyne and *r*-hyoscyne have the same effect on the central nervous system in man and mammals, and on the motor terminations in the frog. In the latter animal, they do not affect the central nervous system. On salivary glands and cardio-inhibitory fibres, *l*-hyoscyne acts twice as strongly as the racemic base. From this it is inferred that *d*-hyoscyne acts equally strongly on the central nervous system, but has no action on secretory or on cardio-inhibitory nerve fibres. *d*-Hyoscyne differs from *d*-hyoscyamine in not stimulating the frog's spinal cord; this may be due to its being so rapidly excreted. Hyoscyamine is devoid of hypnotic action in man when given in doses which do not affect the peripheral organs.

W. D. H.

**Action of Adrenaline.** T. R. ELLIOTT (*J. Physiol.*, 1905, 32, 401—467).—A full account of experiments previously published (Abstr., 1904, ii, 577. Compare also *ibid.*, 832).

W. D. H.

**Physiological Action of Chrysotoxin.** H. H. DALE (*Proc. Physiol. Soc.*, 1905, lviii—lx; *J. Physiol.*, 32).—Chrysotoxin, the active substance of ergot, was injected intravenously in cats. Small doses cause effects similar to those produced by stimulation of sympathetic



nerves (including cranial and sacral autonomic nerves); the seat of stimulation is either the ganglion cells or the endings on them of preganglionic fibres. Larger doses paralyse motor nerve-endings except those of the cranial and sacral autonomic groups; there is no paralysis of inhibitory endings. Whether the same substance is responsible for both classes of effects is doubtful. The paralytic effects permit a new method of discrimination in cases where an organ receives both motor and inhibitory impulses from the sympathetic.

W. D. H.

**Action of Drugs on the Paralysed Iris.** HUGH K. ANDERSON (*Proc. Physiol. Soc.*, 1905, xlix—1; *J. Physiol.*, 32).—After excision of the ciliary and accessory ciliary ganglia, eserine has no effect on the pupil, but pilocarpine causes constriction; the latter effect is annulled by atropine as in the normal eye. Atropine and pilocarpine probably combine with some substance in the sphincter, but atropine has the greater affinity for it. This material is not in the contractile substance, because atropine does not prevent pupillary contraction after death or during asphyxiation. It is not in the nerve fibres as the effect is observed after nerve-degeneration. It must therefore be in the nerve-ending. This connecting link must be composed of two parts, a nervous part excited by eserine, which degenerates after cutting the ciliary nerves, and a muscular portion containing the substance on which atropine and pilocarpine act.

W. D. H.

**Detection of Morphine in Cases of Poisoning.** H. WEFERS BETTINK (*Chem. Centr.*, 1905, i, 1421—1422; from *Pharm. Weekblad*, 42, 302—307).—In a case of morphine poisoning, death occurred after two days notwithstanding the speedy application of the stomach-pump. Morphine hydrochloride crystals were isolated from the contents of the stomach and intestines. No such crystals could be isolated from the blood, spleen, or kidneys, but satisfactory colour reactions were obtained. No morphine could be detected in the brain and liver. The body contained no urine, so this could not be examined. The author thinks that the decided quantity of morphine still present in the stomach, notwithstanding the defæcation, must have deposited from the blood.

L. DE K.

## Chemistry of Vegetable Physiology and Agriculture.

**Action of Some Soil Micro-organisms on Ammonium Sulphate and Sodium Nitrate.** ALBERT STUTZER and W. ROTHE (*Bied. Centr.*, 1905, 34, 433—434; from *Fühling's landw. Zeit.*, 1905, 53, 629).—Experiments with eight varieties of soil micro-organisms showed that ammonium sulphate is a better food than sodium nitrate, and that the production of organic nitrogen compounds by various soil microbes is especially promoted by the presence of calcium carbonate and ammonia.

As regards the solubility of the nitrogenous matter produced, it was found in the case of *Aspergillus glaucus* that 13.5 per cent. dissolved in

water, 44.3 dissolved in pepsin and hydrochloric acid, whilst 42.2 per cent. was insoluble (nuclein). When asparagine was employed, the proteids produced by *Aspergillus glaucus* contained 81 per cent. of insoluble substance (nuclein). In the case of *Streptothrix odorifera*, the proteids produced from asparagine contained 70 per cent. of insoluble matter.

N. H. J. M.

**Action of Ammonium Salts on the Nitrification of Sodium Nitrite by the Nitric Ferment.** E. BOULLANGER and L. MASSOL (*Compt. rend.*, 1905, 140, 687—689. Compare Abstr., 1904, ii, 361).—One per thousand of sodium carbonate is not necessary to the nitric ferment and may be reduced to 0.2 per thousand in Winogradsky and Omeliansky's medium. When the amount does not exceed 0.25 gram per litre, the duration of the conversion of nitrite is not affected by the presence or absence of ammonium sulphate. The injurious action observed by Winogradsky and Omeliansky is attributed to free ammonia liberated by the 0.1 per cent. sodium carbonate; with less sodium carbonate, the ammonia liberated is insufficient to have an injurious action.

N. H. J. M.

**Yeast Catalase.** W. ISSAEW (*Zeit. physiol. Chem.*, 1905, 44, 546—559).—Salts and alkalis act catalytically in the reaction; they have an optimum concentration. Potassium compounds act more favourably than sodium compounds. Weak alkalis extract more catalase from yeast than water. Acids and iodine destroy catalase. The action of catalase increases with the amount present, but not in exact proportion; the increase in action is shown.

W. D. H.

**Non-inverting Yeasts.** HENRI VAN LAER (*Centr. Bakt. Par.*, 1905, ii, 14, 550—556).—Non-inverting aerobic yeasts, in which the life of the "vegetating yeast" dominates, may become inverting. The sucrose utilised for their nutrition undergoes inversion before it is consumed. In the case of *Mycoderma cerevisiae* this does not manifest itself owing to the oxidising power, which is independent of the inversion, predominating.

N. H. J. M.

**Autodigestion of some Varieties of Yeast.** MARTIN SCHENCK (*Chem. Centr.*, 1905, i, 1570—1571; from *Woch. Brau.*, 22, 221—227).—The products of the autodigestion of brewers' yeast and spirit yeast are similar, but in the latter case arginine does not occur, being probably decomposed into tetramethylenediamine, if it pre exists at all in the proteid substances. Extracted yeast cells become brown or black when exposed to air; only those of spirit yeast seem to remain colourless.

N. H. J. M.

**Production of Hydrogen Sulphide by Yeast.** HERMANN WILL and F. SCHÖLLHORN (*Chem. Centr.*, 1905, i, 1570; from *Zeit. ges. Brauw.*, 23, 285—287).—The production of hydrogen sulphide was observed in a "special Pilsen beer" and is attributed to weakening of the Pilsen yeast, resulting in an alteration of its character, the power of producing hydrogen sulphide being induced by addition of gypsum.

N. H. J. M.

**Production of Acetic Acid in Alcoholic Fermentation.** RUDOLF REISCH (*Centr. Bakt. Par.*, 1905, ii, 14, 572—581).—The production of acetic acid in alcoholic fermentation is directly connected with the biological activity of the yeast and only takes place during fermentation. Addition of alcohol is without effect, whilst a small amount of acetic acid entirely checks the production of acetic acid and may even result in a loss of acetic acid possibly owing to some of it forming ethyl acetate.

N. H. J. M.

**Occurrence in Soil of Fungi causing Alcohol Fermentation.** EMIL CHR. HANSEN (*Centr. Bakt. Par.*, 1905, ii, 14, 545—550. Compare *ibid.*, 10, 1).—It is shown that the soil is the most important resort in the winter, and that it is the chief source of the micro-organisms at all times of the year.

N. H. J. M.

**Action of the Radiations from Radium Bromide on some Organisms.** HENRY H. DIXON and J. T. WIGHAM (*Sci. Proc. Roy. Dubl. Soc.* 1904, 10, 178—192).—The experiments indicate that the radiations from radium bromide do not interfere to any marked extent with the metabolism of cells of *Lepidium sativum* and *Volvox globator*. On the other hand, the bacteria *Bacillus pyocyaneus*, *B. prodigiosus*, *B. typhosus*, and *B. anthracis*, when exposed to the radiations at no great distance from the tube, were found to be inhibited in their development, and in some cases perhaps killed. It is possible that the negative electrons from the radium bromide attach themselves to the positive hydrogen ions of the cultures, thus setting free hydroxyl ions. The consequent alkalinity would check the action of the enzymes on which the metabolism of the cells depends, for the action of all enzymes, trypsin excepted, is inhibited in an alkaline solution.

J. C. P.

**Comparative Assimilability of Ammonium Salts, Amides, Amines, and Nitriles.** L. LUTZ (*Compt. rend.*, 1905, 140, 665—667. Compare Abstr., 1898, ii, 530, and 1900, ii, 233).—Results obtained with *Aspergillus niger*, *Aspergillus repens*, and *Penicillium glaucum* showed that amides are the most readily assimilable nitrogenous compounds, giving higher results than Raulin's solution containing ammonium salts. Amines are somewhat less assimilable and nitriles much less.

The assimilability of amines is in inverse relation to their molecular weight.

N. H. J. M.

**Mutual Action of Salts in the Mineral Nutrition of Plants.** P. KOSSOWITSCH (*Bied. Centr.*, 1905, 34, 378—384; from *Journ. exper. Landw.*, 1904, 5, 598).—Plants are able to utilise nitrogen both in the form of ammonium salts and as nitrates. When nitrates are employed, the plant takes up more acid than base, leaving an alkaline substratum which, if not neutralised by some other constituent of the substratum, may cause injury to the development of the plant. In the case of ammonium salts, the plant utilises more base than acid,



so that an acid substratum results unless calcium carbonate, for instance, is present. The acidity thus produced will, if it reaches a certain point, be injurious to the plant; at the same time, however, it acts as a solvent and thus supplies an increased amount of mineral matter. When both forms of nitrogen are supplied (in ammonium nitrate), the reaction of the substratum is not essentially affected and the conditions are favourable for normal growth.

N. H. J. M.

**Estimation of the Carbon Dioxide given off by Roots during their Development.** P. KOSSOWITSCH (*Bied. Centr.*, 1905, 34, 367—372; from *Journ. exper. Landw.*, 1904, 5, 493).—The amount of carbon dioxide given off by mustard roots is very considerable in relation to the amount of ash constituents in the plant. It is doubtful whether the carbon dioxide only acts on the soil or whether it has other functions.

N. H. J. M.

**Action of Vegetable Acids on Phosphates.** ANTONIO QUARTAROLI (*Chem. Centr.*, 1905, i, 1609—1610; from *Staz. sper. agrar. ital.*, 38, 83—113).—The organic acids which usually occur in plants first render insoluble phosphates soluble and then convert them into dihydrogen phosphates. Any free phosphoric acid which may be produced is converted, in the plants, into a dihydrogen salt. This is explained by the lower acidity of organic acids as compared with phosphoric acid, and by their greater affinity as compared with acid phosphates.

N. H. J. M.

**Proteid Formation in Ripening Seeds.** W. ZALESKI (*Chem. Centr.*, 1905, i, 1605—1606; from *Ber. deut. bot. Ges.*, 23, 126—133).—The increase in proteids in ripening peas is coincident with a decrease in the amounts of amino-acids, amides, and organic bases. Albumoses are formed from amino-substances as an intermediate product.

The chemical process in ripening is the reverse of that which occurs in germination.

N. H. J. M.

**Proteolytic Enzyme of Ripening Seeds.** W. ZALESKI (*Chem. Centr.*, 1905, i, 1606—1607; from *Ber. deut. bot. Ges.*, 23, 133—142).—The proteolytic enzymes of pea seeds act in acid, but better in slightly alkaline solutions, and are very sensitive towards further additions of alkaline carbonates. In the auto-digestion of unripe pea seeds, the decomposition of proteids is accompanied by the production of amino-acids which were not identified. Albumoses and peptones are not formed, or do not accumulate, being very readily digested by the pea-preparation. It is uncertain whether the ripening seeds contain only one ferment of a tryptic nature or whether they contain several, including trypsin.

N. H. J. M.

**Successive Distributions of Estragole and Terpenic Compounds among the Different Organs of an Annual Plant.** EUGÈNE CHARABOT and G. LALOUE (*Compt. rend.*, 1905, 140, 667—669. Compare Abstr., 1904, ii, 365).—During the period preceding the

appearance of the first flowers there is an accumulation in the green leaves of an essential oil poor in estragole and rich in terpenic compounds. The first flowers contain a less soluble essence containing more estragole. When the flowering period is advanced, the amount of essential oil diminishes in the green parts and increases in the flowers; at the same time the solubility of the oil in the green parts of the plant diminishes. By the time that the seed has ripened there is loss of essential oil in the flowers and a gain in the leaves; the oil becomes richer in terpenic compounds and more soluble. There is, however, no decrease in the solubility of the essential oil of the flowers.

N. H. J. M.

**Fly Agaric (*Amanita Muscaria*).** II. JULIUS ZELLNER (*Monatsh.*, 1905, 26, 727—747. Compare Heinisch and Zellner, *Abstr.*, 1904, ii, 678).—The acid number of this fungus increases from 38.22 for freshly gathered material to 180.00 for dried twelvemonth-old material; this increase, which is practically complete in four months, during which time about 78 per cent. of the fat present is hydrolysed, is due to the action of a ferment. This is insoluble in water, is not affected by removal of the fat by extraction with light petroleum, and brings about a slow but far-reaching hydrolysis of foreign fats (rape-seed, olive, or castor oils, cocoa butter, or tallow) with which it is mixed. The ferment is best used in the form of the freshly dried and ground fungus; its action is not affected by the addition of small quantities of dilute sulphuric acid or of ammonia.

In addition to the substances previously mentioned, propionic and fumaric acids and amanitole have now been obtained from the fungus.

*Amanitole* is obtained in small quantity on distilling the fungus with steam; it forms colourless, oily drops which solidify to white, flocculent crystals, melts at 40°, has a neutral reaction, is soluble in ether or light petroleum, but is insoluble in aqueous alkali hydroxides.

Ergosterin, which occurs in the fungus to the extent of 0.1—0.2 per cent., crystallises from alcohol in rhombic leaflets which occasionally appear monoclinic, or from benzene, light petroleum, acetone, or carbon disulphide in slender needles. It is soluble in methyl alcohol or chloroform. When shaken with chloroform and sulphuric acid, it gives with the latter a red coloration, which, on dilution with water, becomes green and finally blue, the chloroform remaining colourless (compare Tanret, *Abstr.*, 1889, 407); with acetic anhydride and concentrated sulphuric acid, ergosterin gives a purple coloration which becomes blue and, on addition of water, emerald-green.

The supposed lichensteric acid found in fly agaric by Bolley (*Annalen*, 1853, 86, 44) was probably impure palmitic acid. Two substances from fungus have been named agaricin; Gobley's substance obtained from mushrooms (*J. Pharm. Chim.*, 1856, [iii], 29, 81) was probably ergosterin, whilst Schoonbrodt's (*Jahresber.*, 1864, 613) was mannitol.

G. Y.

**Comparative Experiments on the Manuring of Beet.** KARL ANDRLÍK, VL. STANĚK, and B. MYSÍK (*Zeit. Zuckerind. Böhm.*, 1905, 29, 261—285 and 323—349).—The authors have carried out experi-

ments on the manuring of beet with Chili saltpetre, potassium chloride, potassium sulphate, superphosphate, mineral phosphate, and Thomas slag. The roots, leaves, and leaf-stalks of each crop were separated and examined, and the influence determined of the manures separately and of their various combinations on the ash and its composition, the "harmful ash" (that part which is not eliminated in the extraction of sugar), the quantity and nature of the nitrogenous substances, the sugar-content of the beet, and the purity of the expressed juice. For the detailed results, reference must be made to the original.

In general, large additions of any of the above manures by itself injure the quality of the beet, and cause the beet to take larger quantities of the remaining nutrient materials from the soil. Where the manuring mixture contains all the food-materials required, those administered in excess do not accumulate to any great extent in the roots; the plants, and especially the roots, endeavour to maintain certain relations between the different manure constituents absorbed.

T. H. P.

**Potassium Manuring.** PAUL WAGNER, R. DORSCH, H. RUTHS, and G. HAMANN (*Bied. Centr.*, 1905, 34, 435—446; from *Arb. deut. landw. Ges.*, 1904, Heft 96).—Potassium salts containing much chlorine considerably increased the amounts of chlorine in barley, beet, and especially in the leaves of mangolds and potatoes. Rye grain, which contains only a little chlorine, is not influenced.

The results of numerous field experiments on the relative values of kainite and 40 per cent. potassium salts were in favour of kainite both in the case of arable and meadow land.

N. H. J. M.

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## Analytical Chemistry.

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**Tube Apparatus for Drying in a Current of Carbon Dioxide.** KARL VOIGT (*Chem. Zeit.*, 1905, 29, 691—692).—A modification of the apparatus described by Ulsch (*ibid.*, 1895, 19, 1183) so as to render it more suitable for drying the substance in a current of carbon dioxide. Full illustrations are given.

L. DE K.

**Modification of Bohr's Gas Receiver.** JOSEPH BARCROFT (*Proc. Physiol. Soc.*, 1905, 1—li; *J. Physiol.*, 32).—A simplified and efficient form of receiver for use in analysis of blood gases is described and figured.

W. D. H.

**Standardising of Normal Acids.** JOHN SEBELIEN (*Chem. Zeit.*, 1905, 29, 638—642).—The substance best suited for standardising acids is pure dry sodium oxalate, a weighed quantity of which is converted into carbonate by heating over a spirit lamp (Sørensen's process).



For the details of precautions needful and of the experiments made to determine the various sources of error, the original must be consulted.

L. DE K.

**Use of Benzene or Toluene as Indicator in Iodometry.** BENJAMIN M. MARGOSCHES (*Zeit. anal. Chem.*, 1905, 44, 392—395).—With regard to the use of benzene for this purpose (this vol., ii, 280), the author points out that Moride recommended benzene as an indicator as long ago as the year 1852 (*Compt. rend.*, 1852, 35, 789).

W. P. S.

**Estimation of Fluorine.** JULIUS SCHUCH (*Chem. Centr.*, 1905, i, 1617; from *Zeit. landw. Vers. Wes. Öst.*, 9, 531—549).—A critical investigation of the various recognised processes for the estimation of fluorine. The processes most suitable are the volumetric process of Offermann (Abstr., 1891, 615) and the gasometric method of Hempel and Scheffler (Abstr., 1899, ii, 380).

L. DE K.

**Estimation of Sulphur in Iron Ores, Slags, and Lime.** H. HARTWIGSSON (*Chem. Centr.*, 1905, i, 1616; from *Stahl u. Eisen*, 25, 542—543).—The sample is ignited in a current of pure hydrogen, and any hydrogen sulphide formed is absorbed in two Erlenmeyer flasks containing a solution of cadmium acetate in dilute acetic acid. The reduced mass is then dissolved in dilute hydrochloric acid in a flask from which the air has been expelled previously by a current of carbon dioxide, and the resulting hydrogen sulphide is then passed into the same cadmium solution. The cadmium sulphide formed is estimated iodometrically as usual.

L. DE K.

**Estimation of Sulphur in Roasted Pyrites.** B. N. GOTTLIEB (*Chem. Zeit.*, 1905, 29, 688—689).—A reply to Jene (this vol., ii, 350). The accuracy of the acid process may be interfered with by the presence of barium or lead compounds. If any free sulphur should separate on treating the sample with nitro-hydrochloric acid, a little bromine should be added. If it is desired to ascertain the total amount of sulphur, including that existing as earthy sulphates, the fusion method should be resorted to. The operation may be conducted in an iron crucible.

L. DE K.

**Estimation of Combined Sulphuric Acid [in Waters].** C. BLACHER and U. KOERBER (*Chem. Zeit.*, 1905, 29, 722—723).—One hundred to two hundred c.c. of the sample are boiled down to about 25 c.c. and 20—40 c.c. of *N*/10 alkali (containing equal parts of sodium hydroxide and sodium carbonate) are added. After boiling, the liquid is filtered and the precipitate washed with a mixture of 10 c.c. of water and 10 c.c. of the alkaline solution. The filtrate is mixed with phenolphthalein, boiled, decolorised with hydrochloric acid, and concentrated to 25 c.c. Seventy to ninety c.c. of alcohol are added, the mixture is heated to boiling, neutralised with potassium hydroxide, and then exactly decolorised with *N*/10 hydrochloric acid. After adding 0.5 c.c. of *N*/10 sodium carbonate, the liquid is titrated with *N*/10 barium

chloride until it has become nearly colourless. Another 0.5 c.c. of *N*/10 sodium carbonate is added, the liquid is again heated to boiling, and the titration with barium chloride is continued to the end. One c.c. is then deducted, being due to sodium carbonate. L. DE K.

**Nitrogen Estimations in Lysine and Analogous Substances by Kjeldahl's Method.** S. P. L. SÖRENSEN and A. C. ANDERSEN (*Zeit. physiol. Chem.*, 1905, **44**, 429—447. Compare Kutscher and Steudel, *Abstr.*, 1903, ii, 687; Sørensen and Pedersen, *ibid.*, 1904, ii, 83).—The low results obtained in estimating nitrogen in lysine by the Kjeldahl method are not due, as stated by Henderson, Kutscher, and others, to the evolution of hydrogen cyanide during the heating with concentrated sulphuric acid, but rather to the formation of piperidine-2-carboxylic acid.

Good results have been obtained by the ordinary Kjeldahl method with pyrrolidine-2-carboxylic acid,  $\alpha$ -amino- $\delta$ -hydroxyvaleric acid,  $\alpha\delta$ -diaminovaleric acid,  $\alpha\delta$ -diaminoadipic acid, all such compounds as can yield a cyclic compound containing four carbon and one nitrogen atom.

Pyridine, piperidine, lysuric acid, dibenzoyl-lysine, and ethyl trimethylenediphthaliminomalonate all give low results by the ordinary method, but yield good results when Gunning's (*Abstr.*, 1889, 796) or Arnold and Wedermeyer's modification (*ibid.*, 1892, 1517) is employed (compare Bredig and Brown, *Abstr.*, 1904, ii, 247).

Compounds which contain a CO group in place of a CH<sub>2</sub> group in the piperidine ring give theoretical yields by the ordinary Kjeldahl method; examples are Gabriel's ethyl  $\gamma$ -phthaliminopropylmalonate (*Abstr.*, 1890, 1129; 1891, 948), piperidone, and also  $\gamma$ -aminopropylmalonic acid.

$\alpha$ -Aminoadipic acid can be analysed by the ordinary Kjeldahl method with good results. J. J. S.

**Assay of High-grade Nitric Acid.** F. WINTERER (*Chem. Zeit.*, 1905, **29**, 689).—An improved table showing the percentage of real nitric acid (HNO<sub>3</sub>) corresponding with the sp. gr. (or degree Beaumé) of the sample. The sp. gr. ranges from 1.485 to 1.520. L. DE K.

**Titration of Nitrous Acid with Quadrivalent Cerium.** GIUSEPPE BARBIERI (*Chem. Zeit.*, 1905, **29**, 668—669).—The author has noticed that a solution of ceric sulphate is reduced quantitatively to the cerous condition by an alkali nitrite. The reduction proceeds rapidly in the cold, and the end reaction is indicated by the disappearance of the yellow colour. Still better results might be obtained by adding an excess of ceric sulphate and titrating the undecomposed portion with potassium iodide. The cerium solution need not be perfectly free from other metals of the cerium group, but should be checked iodometrically or by von Knorre's method.

L. DE K.

**Estimation of Phosphoric Acid.** FRITZ RASCHIG (*Zeit. angew. Chem.*, 1905, **18**, 953).—A reply to Hlavnicka (*this vol.*, ii, 419), in

which the author upholds the accuracy and suitability of his process (this vol., ii, 284). According to Schucht, the titration with methyl-orange as indicator may be rendered more delicate by the use of a blue glass; the moment acidity is reached the liquid, when viewed through the glass, turns green suddenly.

L. DE K.

**Estimation of the Citrate-soluble Phosphoric Acid in Superphosphates.** OTTO SEIB (*Zeit. anal. Chem.*, 1905, 44, 397—398).—2.5 grams of the superphosphate are triturated in a mortar with 10 c.c. of a warm mixture of 20 c.c. of sulphuric acid and 80 c.c. of water. The solution is decanted into a 250 c.c. flask, and the trituration repeated three times, the superphosphate being then rinsed into the flask with the remainder of the acid mixture. The flask and its contents are shaken in a shaking-apparatus for 30 minutes, after which the volume is made up to 250 c.c. with water. The solution is filtered and the phosphoric acid estimated in 50 c.c. of the filtrate, as usual, by means of magnesia mixture. The results obtained agree well with those yielded by Petermann's method, the latter being the official method in Belgium.

W. P. S.

**Estimation of Boric Acid.** KARL WINDISCH (*Zeit. Nahr. Genussm.*, 1905, 9, 641—660).—An interesting and most complete review of the processes recommended in recent times for the estimation of boric acid. As regards the volumetric estimations, it appears that mannitol is preferable to glycerol when titrating with phenolphthalein as indicator, as it is always free from acidity, and does not sensibly increase the bulk of the liquid.

L. DE K.

**Estimation of Boric Acid.** WILHELM VAUBEL and E. BARTELT (*Chem. Zeit.*, 1905, 29, 629—630).—The well-known glycerol method is recommended. Attention is called to the necessity of titrating with standard potassium hydroxide free from carbon dioxide. If the liquid should contain the latter, it must be expelled by boiling, the flask being covered with a funnel or attached to a reflux condenser.

Phosphoric acid should be absent; other mineral acids are first neutralised, using dimethylaniline-orange as indicator. Sulphurous acid must be expelled by boiling with dilute sulphuric acid. After the final titration with phenolphthalein as indicator, more glycerol should be added to see whether the colour is permanent.

No estimation should be made without a satisfactory reaction being obtained with turmeric paper. The reaction should then be further confirmed by moistening the paper with soda solution, which causes a coloration varying from greenish-blue to greenish-brown, changing to a pure brown on drying. The presence of phosphoric acid somewhat affects the delicacy of the test.

L. DE K.

**Detection of Boric Acid in Foods.** G. SELLIER (*Ann. Chim. anal.*, 1905, 10, 235—236).—The process is more particularly devised for the detection of borates in substances which it is difficult to reduce



to a white ash, such as white of egg, meat products, &c. Ten grams of the sample are heated in a Kjeldahl flask with 12 c.c. of sulphuric acid until it has dissolved to a dark brown liquid. When partially cooled, 10 c.c. of methyl alcohol are added, the mass is again gently heated, and the escaping vapours are ignited, when the least trace of boric acid will be revealed by the green colour of the flame.

L. DE K.

**Estimation and Separation of Silica and Fluorine.** FERDINAND SEEMANN (*Zeit. anal. Chem.*, 1905, 44, 343—387).—In the course of a critical study of the various methods employed for the estimation and separation of silica and fluorine, particularly in cases where they occur together, as in minerals, the author finds that silica is best separated by precipitation with mercuric ammonium carbonate. The latter may be prepared by adding ammonium carbonate to a mercuric chloride solution until the precipitate which forms re-dissolves, or by digesting freshly precipitated mercuric oxide with an excess of ammonium carbonate solution. The silicate solution, if alkaline, should be nearly neutralised with hydrochloric acid before adding the reagent, and the mixture must be twice evaporated to dryness with the reagent in order to obtain a precipitate which is readily filtered and washed. On ignition, anhydrous silica is obtained. Precipitation of silica by means of ammoniacal zinc solution is not quite trustworthy. The filtrate from the silica-mercury precipitate may be used for the estimation of the fluorine, and for this purpose the methods described by Fresenius, Brandl, Oettel, Carnot, or Offermann are all suitable. The estimation of fluorine as calcium fluoride is not recommended.

W. P. S.

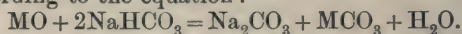
**Analysis of Saltpetre.** R. BENSEMANN (*Zeit. angew. Chem.*, 1905, 18, 939).—Further minute details as to the assay of Chili saltpetre by means of the oxalic acid process already described (this vol., ii, 481). If a chlorate should be present, it will also be converted into an oxalate, and must be allowed for.

L. DE K.

**Estimation of Magnesium and Phosphoric Acid as Magnesium Pyrophosphate.** K. K. JÄRVINEN (*Zeit. anal. Chem.*, 1905, 44, 333—342. Compare *Abstr.*, 1904, ii, 515).—For the estimation of magnesia, the following method gives correct results, no excess of phosphate being included in the precipitate. The solution, which should not contain an excessive quantity of ammonium salts, is exactly neutralised, using lacmoid as indicator. A slightly ammoniacal diammonium phosphate solution is then added drop by drop. After a time, when the greater part of the precipitate has separated, 1 per cent. ammonia is added, and then 10 per cent. ammonia in quantity equal to one-third the volume of the whole. The precipitate is collected on a filter at the end of two hours, dried, and ignited over a Bunsen flame, but not over a blast flame. The presence of ammonium oxalate in moderate quantity has no influence on the precipitation.

W. P. S.

**A Method in Qualitative Analysis for determining the Presence of certain Metallic Oxides.** CHARLES R. C. TICHBORNE (*Sci. Proc. Roy. Dubl. Soc.*, 1904, 10, 331—334).—When certain oxides are either shaken for some time or ground up with a 10 per cent. solution of sodium hydrogen carbonate, the filtered extract gives a deep crimson coloration with phenolphthalein, whereas sodium hydrogen carbonate solution alone gives no colour or only a faint pink. The oxide acting on the acid carbonate produces some of the normal carbonate according to the equation :



The reaction is given readily by litharge, silver oxide, yellow precipitated mercuric oxide, bismuth oxide, stannic oxide, antimony oxide, moist ferrous oxide, precipitated magnetic oxide of iron, precipitated manganous oxide, and zinc oxide (either flowers of zinc, or that obtained by ignition of the carbonate). The reaction is not given by red lead, precipitated mercurous oxide, cupric oxide, alumina, precipitated ferric oxide, or manganese dioxide, whilst with red, crystalline mercuric oxide and cuprous oxide it is not very satisfactory. In general, hydroxides and oxides formed in the moist way bring about the decomposition; those that have been ignited do not act so well.

J. C. P.

**Estimation of Acetic Acid in White Lead.** GUSTAVE W. THOMPSON (*J. Soc. Chem. Ind.*, 1905, 24, 487—488).—The author states that the acetic acid often contained in white leads cannot be completely liberated by treatment with dilute sulphuric acid (Lunge's process), and proposes the following method. Eighteen grams of the sample are placed in a 500 c.c. flask arranged for connection with a steam supply and attached to a Liebig's condenser. Forty c.c. of syrupy phosphoric acid, 50 c.c. of water, and 18 grams of zinc dust are added and the whole is distilled to a small bulk. Steam is now admitted until the flask is half filled with condensed water, when the steam is shut off and the contents again boiled down to a small bulk; this operation is conducted twice. The distillate is then mixed with 1 c.c. of phosphoric acid, and, if necessary, with a little silver phosphate to retain traces of hydrochloric acid, and redistilled. When about 20 c.c. are left in the distilling flask, steam is passed until about 200 c.c. of water has condensed, which is then again boiled down to a small bulk. The operation is repeated until finally 10 c.c. of the distillate requires for neutralisation not more than 0.1 c.c. *N*/10 alkali, using phenolphthalein as indicator. In the titration it will be found convenient to titrate the distillate when it reaches 200 c.c., and then to titrate each subsequent portion of 200 c.c.

L. DE K.

**Analysis of Copper Ferrocyanide.** AUGUSTE LEUBA (*Ann. Chim. anal.*, 1905, 10, 218—219).—About 0.5 gram of the material is boiled in a reflux apparatus for two hours with a 5 per cent. solution of oxalic acid. The golden-yellow liquid is passed through a filter and the washed precipitate is dissolved in dilute nitric acid, the solution being then added to the main filtrate. After concentrating the liquid on the

water-bath, the iron and copper are separated by the ordinary process. Other metallic ferrocyanides cannot be analysed by the oxalic acid process.

L. DE K.

**Separation of Iron from Nickel and Cobalt by Aid of Formic Acid.** LEONARD H. BORGSTRÖM (*Chem. Centr.*, 1905, i, 1667; from *Bull. Com. Géol. Finlande*, 1903, No. 14, 1—80. See this vol., ii, 538).

**Quantitative Separation of Gold from other Metals by Hydrazine or Hydroxylamine Salts.** PAUL JANNASCH and O. VON MAYER (*Ber.*, 1905, 38, 2129—2130).—Gold is precipitated quantitatively from solutions of its salts, whether neutral, acid, or alkaline, by the addition of hydrazine salts. The state of aggregation and the colour of the metal depend largely on the temperature and on the other substances which are present. Hydroxylamine produces a similar effect when used in hydrochloric acid solution at a temperature of 80°; the precipitation, however, proceeds more slowly and for quantitative purposes the mixture must be heated for some time on the water-bath. Gold may be separated from potassium, sodium, barium, strontium, calcium, magnesium, aluminium, chromium, zinc, manganese, iron, uranium, nickel, cobalt, cadmium, mercury, lead, and copper, but not from tin, by these methods.

J. J. S.

**Reaction of Hydrazine and Hydroxylamine Salts with Salts of the Platinum Metals and Separation of these from Gold.** PAUL JANNASCH and O. VON MAYER (*Ber.*, 1905, 38, 2130—2131).—Gold may be separated from palladium by precipitating the gold with hydroxylamine hydrochloride in hydrochloric acid solution, and then the palladium by means of hydrazine hydrochloride. In a similar manner, gold may be separated quantitatively from platinum, iridium, rhodium, or osmium. Osmium, however, is not completely precipitated by hydrazine in alkaline solution and in acid solution yields no trace of precipitate.

J. J. S.

**Physico-chemical Analysis of Soils.** H. LAGATU (*Compt. rend.*, 1905, 140, 669—672).—A geometrical method is suggested for interpreting the results of the physical and chemical analyses of soils, a single value being obtained from three variable numbers (as, for instance, clay, fine sand, and coarse sand, or calcium carbonate, clay, and silica) having a constant sum.

N. H. J. M.

**Estimation of Alcohol in Beers by means of the Zeiss Immersion Refractometer.** EDWIN ACKERMANN and ALBERT STEINMANN (*Chem. Centr.*, 1905, ii, 1672; from *Zeit. ges. Brauw.*, 20, 259—260).—The authors state that the estimation of the alcohol in beers may be effected with advantage by means of the refractometer, and have for this purpose constructed a special table.

The method does not, however, seem suitable for wine distillates.

L. DE K.



**Estimation of Glycerol by the Extraction Method.** WILLY LANDSBERGER (*Chem. Rev. Fett Harz Ind.*, 1905, 12, 150—152).—Compared with estimations by the acetin-method, the extraction method of Shukoff and Schestakoff (this vol., ii, 289) gives closely concordant results, especially in the estimation of glycerol in the solutions obtained by the decomposition of fats and oils by ferments. The solutions experimented with contained from 8.5 to 22 per cent. of glycerol, but good results were also obtained in the case of crude glycerols containing upwards of 80 per cent. of glycerol.

W. P. S.

**Estimation of Sugar with Fehling's Solution.** F. P. LAYALLE (*Ber.*, 1905, 38, 2170).—To overcome the difficulty of recognising the end-point when Fehling's solution is used to estimate sugar in solutions containing other impurities, excess of an alkali is added. The separation of cuprous oxide is prevented and the end-point sharply characterised by the disappearance of the blue colour. Five to ten c.c. of Fehling's solution are placed in a porcelain dish, 30 c.c. of aqueous sodium hydroxide (1:3) and 50—60 c.c. of distilled water added, the mixture heated to boiling, and the sugar solution then run in.

E. F. A.

**[Approximate] Estimation of Reducing Sugars and Dextrins in presence of Starch and Soluble Starch.** JULES WOLFF (*Ann. Chim. anal.*, 1905, 10, 233—235).—The liquid resulting from the maceration of 25 c.c. of a 4.5 per cent. starch paste and 5—10 c.c. of barley extract is diluted to 50 c.c., and in 10 c.c. of this the reducing sugar (maltose) is estimated as usual by the copper process. Twenty-five c.c. of the solution are then diluted to 50 c.c. with saturated barium hydroxide, which precipitates the starch whether dissolved or still in the state of paste. Twenty-five c.c. of the filtrate are then mixed with 0.25 c.c. of sulphuric acid and heated in an autoclave for 20 minutes at 120° in order to convert the dextrins and the maltose into dextrose. The liquid is diluted to 50 c.c., filtered, and treated with copper solution as usual. The total dextrose thus found represents the starch actually acted on by the barley extract in a certain time. The figures obtained also enable the amount of dextrin to be calculated. In this process, due allowance must, of course, also be made for the reducing matters contained in the barley extract.

L. DE K.

**Estimation of Saccharose in presence of Lævulose and Dextrose.** HENRI PELLET and L. PELLET (*Chem. Centr.*, 1905, i, 1572—1573; from *Bull. Assoc. Chim. Sucr. et Dist.*, 22, 744—752).—In reply to Dupont, the authors state that the Clerget formula with suitable modification may be safely applied in the polarimetric estimation of saccharose in cane-sugar molasses. The estimation is not affected by a slight excess of acetic or sulphurous acid.

L. DE K.

**Estimation of Saccharose in presence of Dextrose and Lævulose.** FRANÇOIS DUPONT (*Chem. Centr.*, 1905, i, 1573; from *Bull. Assoc. Chim. Sucr. et Dist.*, 22, 753).—The author, in reply to

Pellet and Pellet (see preceding abstract), now states that he agrees with their views. L. DE K.

**Formation of Lactosazone.** W. C. DE GRAAFF (*Chem. Centr.*, 1905, i, 1573; from *Pharm. Weekblad*, 42, 346—349).—1.5 mg. of the supposed lactose is boiled for two minutes with 1 drop of phenylhydrazine and 2 drops of acetic acid. Water is added until the mixture becomes turbid and it is then examined under the microscope after adding some more water to the slide. In the presence of lactose, typical globular aggregates of small, sharp, bright yellow needles of lactosazone are formed. When dealing with very small traces of lactose, the solution may be agitated with benzene and the latter allowed to evaporate. Sometimes it is necessary to recrystallise the osazone. L. DE K.

**Estimation of  $\beta$ -Hydroxybutyric Acid in Urine.** JOHN H. RYFFEL (*Proc. Physiol. Soc.*, 1905, lvi—lviii; *J. Physiol.*, 32).—The method consists in heating the urine with sodium hydroxide and ammonia to prevent frothing, adding sulphuric acid, distilling with steam, and determining the crotonic acid which passes over by saturating with bromine and estimating the excess of bromine iodometrically. W. D. H.

**[Detection of] Glyoxylic Acid.** HANS EPPINGER (*Beitr. chem. Physiol. Path.*, 1905, 6, 492—501. See this vol., ii, 543).

**Estimation of Glycuronic Acid.** BERNHARD TOLLENS (*Zeit. physiol. Chem.*, 1905, 44, 388—390. Compare Neuberg and Neimann, this vol., ii, 426; Tollens and Chalmot, *Abstr.*, 1891, 768; Mann and Tollens, 1895, ii, 335).—It is pointed out that the method previously described gives approximate results. J. J. S.

**Chemical Analysis and Cryoscopy of Milk.** HENRI LAJOUX (*J. Pharm. Chim.*, 1905, [vi], 21, 577—591).—The freezing point of pure milk was found to lie between  $-0.54^{\circ}$  and  $-0.58^{\circ}$ . For the mixed milk of many cows, the freezing point is practically constant at  $-0.55^{\circ}$ , but the milk of any individual cow may give a figure as low as  $-0.54^{\circ}$ . The freezing point is not affected by the feeding or breed of the animal, or by the season of the year. The addition of water to milk raises the freezing point of the latter, and the percentage quantity of added water may be calculated from the reading obtained. The amount of fat in the milk is without influence. W. P. S.

**Saponification of Fat by Ammonia in the Röse-Gottlieb Method of estimating Fat in Milk.** ANTON BURR (*Milchw. Zentr.*, 1905, 1, 248—250).—The results of the experiments described in this paper show that none of the fat is saponified by the excess of ammonia used in the Röse-Gottlieb method. Emulsions of butter fat and water, when analysed by this process, yielded the amounts of fat originally weighed out, showing that no loss of fat, due to possible

saponification, had taken place. In the case of milk, the risk of saponification is, moreover, still less, as a considerable portion of the ammonia combines with the casein. W. P. S.

**New Test for Formalin in Milk.** FRANZ UTZ (*Chem. Zeit.*, 1905, 29, 669).—Equal parts of milk and hydrochloric acid of sp. gr. 1.19 are heated with a few granules of vanillin. If formalin is not present, the liquid turns a beautiful violet or raspberry colour, but if traces of formalin are present the liquid turns yellow. The reaction is stated to be very delicate. L. DE K.

**The Sichler "Sinacid Butyrometry."** WILHELM SCHNEIDER (*Chem. Zeit.*, 1905, 29, 690).—The author having made comparative experiments with the methods of Gerber and of Sichler for the estimation of fat in milks, pronounces in favour of the former. The experiments were made both with cow's and goat's milk. L. DE K.

**Oxidising Action of Impure Ether containing Peroxide, and its Influence on Kreis's Reaction.** HUGO DITZ (*Chem. Zeit.*, 1905, 29, 705—710).—When a rancid specimen of cocoa-nut oil is agitated with an equal volume of concentrated hydrochloric acid and a freshly prepared solution of phloroglucinol in ether is added, Kreis's colour reaction does not take place. The reaction does take place, however, when special precaution is taken to free the ether used from any peroxide contained in it. The ethyl peroxide present in impure ether exerts a much stronger oxidising action than does the hydrogen peroxide present.

Kreis's reaction also takes place when phenols containing two hydroxyl groups in the meta-position are substituted for phloroglucinol. A. McK.

**Detection of Linseed Oil in Nut Oil.** GEORGES HALPHEN (*Bull. Soc. chim.*, 1905, [iii], 33, 571—572).—The test used is a special form of that already described (*Abstr.*, 1902, ii, 293). Sufficient bromine is added to 10 c.c. of carbon tetrachloride to make 15 c.c. of liquid, of which 1 c.c. is added to 0.5 c.c. of the oil, previously dissolved in 10 c.c. of ether. This mixture is then warmed at 25°, when, if linseed oil is present, a precipitate is formed in less than two minutes. A precipitate is eventually formed under these conditions with nut oil alone, but only after the lapse of at least seven minutes. The presence of poppy oil, which is sometimes added as an adulterant, does not interfere with the test. T. A. H.

**Estimation of Certain Hydrazides.** CONCETTO MASELLI (*Gazzetta*, 1905, 35, i, 267—273).—When aqueous solutions of salts of semicarbazide or semioxamazide are boiled with dilute acids, decomposition occurs with quantitative separation of ammonia and hydrazine, according to the equations:  $\text{NH}_2 \cdot \text{CO} \cdot \text{NH} \cdot \text{NH}_2 + 2\text{H}_2\text{O} = \text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} + \text{N}_2\text{H}_4$  and  $\text{NH}_2 \cdot \text{CO} \cdot \text{CO} \cdot \text{NH} \cdot \text{NH}_2 + 2\text{H}_2\text{O} = \text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} + \text{N}_2\text{H}_4$ .



The quantity of semicarbazide in a solution can hence be estimated either (1) by determining the amount of hydrazine set free by adding a known volume in excess of a standard solution of potassium iodate, boiling until all the iodine separated is removed, and titrating the liquid with standard sodium thiosulphate solution to determine the excess of potassium iodate remaining in the solution, or (2) by determining the amount of ammonia set free by rendering the liquid alkaline with sodium hydroxide and distilling the ammonia into a known volume of standard acid solution. Both these methods give excellent results. With the semioxamazide, oxalic acid is formed on boiling with dilute sulphuric acid, so that in this case only the ammonia method can be used for the estimation; here also very good results are obtained.

T. H. P.

**Detection of Antipyrine in Dimethylaminoantipyrine [Amidopyrine].** PAUL BOURCET (*Bull. Soc. chim.*, 1905, [iii], 33, 572—573).—An admixture of 2 per cent. or more of antipyrine with the more expensive substance amidopyrine may be detected by adding a few drops of sulphuric acid and then a small quantity of a saturated solution of sodium nitrite to a solution of from 0.01 to 0.02 gram of the suspected material in 4 to 5 c.c. of water. If antipyrine is present, a comparatively stable, intense bluish-green coloration is obtained, whereas with amidopyrine alone a fugitive bluish-violet colour is produced. The amount of antipyrine present may be approximately determined by the depth and character of the coloration.

T. A. H.

**Use of Potassium Bismuth Iodide for the Estimation of Alkaloids.** HERMANN THOMS (*Chem. Centr.*, 1905, i, 1341—1342; from *Ber. Deut. pharm. Ges.*, 15, 85—91).—The sulphuric acid solution of the alkaloid is precipitated with 10 c.c. of the ordinary potassium bismuth iodide reagent, and the precipitate is washed with 10 c.c. of 5 per cent. sulphuric acid. The precipitate and filter are now transferred to a wide-mouthed 200 c.c. stoppered cylinder and well shaken with a mixture of 10 grams of powdered crystallised sodium carbonate and 10 c.c. of 10 per cent. sodium hydroxide. Fifty c.c. of ether (added in 2 portions of 25 c.c.) are added, and the whole is gently shaken for 20 minutes, the cylinder being held vertically. Twenty-five c.c. of the ethereal layer are then pipetted off and titrated with *N*/100 hydrochloric acid, with iodeosin as indicator. L. DE K.

**Alkaloid Reactions. Quinine and Cinchonine.** C. REICHARD (*Chem. Centr.*, 1905, i, 1438—1439; from *Pharm. Zeit.*, 50, 314—315).—If a few drops of a strong solution of mercurous nitrate are evaporated on a porcelain lid and the residue mixed with a trace of quinine or cinchonine sulphate and a drop of water, reduction of mercury takes place, particularly with cinchonine. Mercuric chloride is but slightly reduced. A mixture of copper oxychloride with quinine and a little hydrochloric acid turns yellowish-red; cinchonine acts a little more slowly. A hydrochloric acid solution of basic

bismuth nitrate causes a slight yellow coloration. If a drop of strong ferric chloride is allowed to dry on a porcelain lid and the spot is covered with a little quinine or cinchonine sulphate, the addition of a drop of water will cause a dark brown mass, which turns green on adding a drop of strong sulphuric acid. When treated with ammonium persulphate and a drop of sulphuric acid, quinine gives a passing yellow colour, whilst cinchonine remains perfectly colourless. With potassium dichromate and sulphuric acid, both alkaloids give a dark, blue colour passing into bluish-green. The following reactions distinguish quinine from cinchonine. With sulphuric acid and ammonium molybdate, quinine gives a pale blue colour, gradually darkening, whilst cinchonine gives at once a dark blue colour. If these blue mixtures are warmed with a little ammonium persulphate, they both effervesce and turn deep yellow. If now to the mixture is added a little 40 per cent. formaldehyde, and then a drop of strong potassium thiocyanate, the cinchonine mixture turns a dark reddish-brown, whilst the quinine mixture is not affected.

L. DE K.

#### Estimation of Betaine in the Products of Sugar Factories.

VLADIMÍR STANĚK (*Zeit. Zuckerind. Böhm.*, 1905, 29, 410—417. Compare Abstr., 1904, ii, 790).—The author has applied the method for estimating betaine previously described by him (*loc. cit.*) to the products of sugar factories. These products contain purine substances, peptones, and proteids, which are all precipitated by a solution of iodine in potassium iodide solution. The betaine may, however, be separated from these by means of cupric or cuprous salts, the procedure being as follows: the material (raw sugar, syrup, molasses, &c.) is dissolved in 10 per cent. sulphuric acid solution saturated with sodium chloride, after which the potassium tri-iodide solution is added drop by drop as long as a precipitate is formed. A few grams of moist powdered iodine, obtained by precipitation of an acidified solution of iodine in potassium iodide by means of sodium nitrite, is then added and the whole thoroughly mixed. After six hours, the liquid is decanted on to a Gooch filter, the precipitate being then broken up with a glass rod and also transferred to the filter, where it is washed with saturated sodium chloride solution. The precipitate is mixed with water, and finely divided copper (precipitated from a solution containing zinc and copper sulphates by means of zinc) is added until the precipitate becomes light in colour and the odour of iodine disappears, the liquid being heated and stirred meanwhile. The solution is then boiled and sufficient cupric hydroxide (precipitated from an aqueous glycerol solution of copper sulphate by sodium hydroxide) added to give the yellow precipitate a green colour. The cooled liquid is filtered through a Gooch crucible and the residue washed ten times with cold water. The nitrogen in the precipitate, which consists mainly of cuprous iodide, is then determined by Kjeldahl's method. The nitrogen in the total filtrate, which contains the betaine, is also determined by Kjeldahl's method and is calculated as betaine; 1 c.c. of *N*/10 sulphuric acid corresponds with 0.013156 gram of crystallised betaine. This method gives good and concordant results for all the important products of the sugar factory. The betaine separated in this

manner contains small quantities of another nitrogenous substance, probably choline, and traces of an apparently nitrogen-free compound.  
T. H. P.

**Alkaloid Reactions. Nicotine and Coniine. II.** C. REICHARD (*Chem. Centr.*, 1905, i, 1486; from *Pharm. Centr.-H.*, 46, 309—313. Compare Abstr., 1904, ii, 792 and 847).—When a drop of nicotine and then a drop of hydrochloric acid are added to finely powdered dry copper oxychloride, the mass becomes violet-blue, whilst coniine under similar conditions forms a bright green solution which gradually becomes colourless. The residue left by allowing a drop of a concentrated aqueous solution of mercurous nitrate to evaporate on a porcelain plate, when treated with coniine or nicotine, gives a deep black coloration at once in the first case, but only gradually in the second. If mercuric chloride is used instead of mercurous nitrate, both alkaloids give a very slight yellow coloration, which, on the addition of a drop of sulphuric acid, becomes faintly red when nicotine is present, but colourless when coniine is present. When coniine is added to an equal quantity of cobalt nitrate, the mixture becomes violet, whilst nicotine forms a violet-blue coloration. The residue left by allowing an aqueous solution of  $\alpha$ -nitroso- $\beta$ -naphthol to evaporate, when treated with coniine or nicotine, gives a green or a yellowish-brown coloration respectively. A solution of  $\alpha$ -naphthol added to a drop of coniine or nicotine is colourless, but on addition of hydrochloric acid the nicotine solution turns yellow, whilst the coniine remains unchanged. An intense yellow coloration is gradually formed when hydrochloric acid is added to a mixture of bismuth subnitrate with nicotine, but coniine under similar conditions remains white. A trace of nicotine, when added to a 40 per cent. solution of formaldehyde, immediately produces a yellow coloration, and on adding a drop of concentrated sulphuric acid the colour becomes similar to that of a dilute solution of cobalt nitrate; coniine and sparteine do not give these reactions. Nicotine may also be distinguished from coniine or sparteine by the yellow coloration which is formed when the alkaloid is mixed with a few crystals of ammonium persulphate and concentrated sulphuric acid added. E. W. W.

**Alkaloid Reactions (Sparteine, Coniine, Nicotine).** C. REICHARD (*Chem. Centr.*, 1905, ii, 171—172; from *Pharm. Centr.*, 48, 385—388).—A series of new tests are given for *sparteine*, the most characteristic of which are as follows: sodium picrate gives a yellow with sparteine and coniine but a reddish-yellow with nicotine. On adding sulphuric acid, the nicotine mixture turns yellow. If to the three mixtures is now added a little ammonium persulphate and a drop of strong potassium thiocyanate, the sparteine assumes a fine orange-red colour, while the others are not affected. On evaporating a mixture of ferric chloride and potassium thiocyanate and then moistening the spot with water containing sparteine, the mixture turns a beautiful bluish-violet; nicotine and coniine give a green colour.

New tests are also given for *coniine* and *nicotine*, of which the following are the most characteristic. Nicotine gives a yellowish-green with ammonium molybdate; coniine and sparteine are not affected. If



nicotine is added to a mixture of ammonium molybdate and sulphuric acid the mixture also turns a yellowish-green which, on adding ammonium persulphate, becomes a beautiful purplish-violet, gradually changing to dark yellow. Coniine and sparteine give a faint blue colour which turns dark yellow with persulphate.

When nicotine is added to powdered potassium ethyl sulphate moistened with sulphuric acid, the mass turns first yellow and then red; coniine and sparteine give no reaction.

L. DE K.

**Estimation of Lecithin in Grape Stones and in Wine.** F. MURARO (*Gazzetta*, 1905, 35, i, 314—319).—The author's experiments show that absolute alcohol extracts lecithin from grape stones more completely at 80° than at 50°, but that with wines the maximum amount of lecithin is extracted at 50°, the quantity obtained at 80° being, however, greater than that yielded by neutralised wine at the same temperature.

It is probable that the conclusions of Weirich and Ortlieb (*Abstr.*, 1904, ii, 304) are incorrect and that pasteurised wines still contain lecithin.

T. H. P.

**Malt Analysis. II. Estimation of Moisture and Extract.** JOHN SIMPSON FORD and JOHN M. GUTHRIE (*Journ. Inst. Brewing*, 1905, 11, 326—344).—The ordinary method of estimating the moisture of malt, by drying in a steam-oven or in an air-oven at 105°, gives results which are both erroneous and inconsistent, since many malts gain in weight owing to oxidation by the air. Perhaps the most satisfactory results are arrived at by drying the malt at 110° in a current of hydrogen, absorbing the expelled water by means of sulphuric acid or phosphoric oxide, and checking the result by noting the loss in weight of the malt; the figures are in general identical. The use of vacuum drying appliances at 105—110° would undoubtedly yield results approximate to the truth, but such appliances are expensive and troublesome; where, however, a correct value is required, as in the determination of extract by the "proportionality" or "known weight" method, they should be employed. For uniformity of result, all that is required is the use of an inert gas, preferably carbon dioxide, in conjunction with the ordinary water-oven, the values thus obtained being concordant, although probably lower than the real values. The authors describe a suitable carbon dioxide generator and reservoir connected with a steam-oven.

The authors discuss the different methods in use for the estimation of the "extract" of malts, and conclude that the most convenient is that given by Heron. They find, however, that 10 c.c. is a more exact average volume of the grains obtained from 50 grams of malt than 15 c.c., as stated by Heron.

T. H. P.

## General and Physical Chemistry.

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**Emission of Light from the Vapours of Alkali Metals and their Salts, and the Centres of this Emission.** PHILIPP LENARD (*Ann. Physik*, 1905, [iv], 17, 197—247).—The experimental part of this paper deals with the coloured glow exhibited by fused salts of the alkali metals. The glow in the case of caesium and rubidium is yellowish-green, in the case of potassium green, in the case of sodium bright blue, in the case of lithium duller blue. These glow colours are attributed to the metallic cation. The continuous ground visible in flame spectra of salts of the alkali metals is probably emitted also by the metallic cations.

The paper contains many other detailed observations and theoretical propositions, for which the original must be consulted. J. C. P.

**Limits of Visibility of Fluorescence and the Maximum Value of the Absolute Weight of the Atom of Hydrogen.** WALTHER SPRING (*Bull. Acad. roy. Belg.*, 1905, 201—211).—A solution of fluorescein in optically pure water was subjected to the action of a powerful beam of electric light, and the limit of dilution was observed at which a visible green fluorescence was produced. Assuming under these conditions that one cubic millimetre of the solution contained one molecule of fluorescein ( $C_{20}H_{10}O_5K_2 = 408$ ), the value  $2.5 \times 10^{-21}$  grams is obtained for the superior limit of the weight of the atom of hydrogen, which is one-twenty-thousand-millionth part of the value  $5 \times 10^{-11}$  calculated by Annaheim (this Journal, 1877, i, 31), but is about seven thousand times as great as the value  $3.45 \times 10^{-25}$  calculated from the kinetic theory of gases. P. H.

**Photochemical Action of Mercuric Oxalate (Eder's Solution) in Absence of Oxygen and in Presence of Fluorescent Compounds.** A. JODLBAUER and HERMANN VON TAPPEINER (*Ber.*, 1905, 38, 2602—2609. Compare Abstr., 1904, i, 131; Gros, *ibid.*, 1901, ii, 433).—Numerous investigators have shown previously that processes of oxidation, for example, of hydriodic acid, fluorescein, potassium iodide, silver, arsenious acid, benzyl alcohol, and salicylaldehyde are accelerated by the presence of a fluorescent substance such as acridine, quinine, erythrosin, &c.

Experiments are now described which prove that processes other than oxidations, for example, the photochemical decomposition of Eder's solution (Roloff, Abstr., 1894, ii, 221), are accelerated by the presence of fluorescent substances such as fluorescein, its chloro-, bromo-, and iodo-derivatives, dichloro-anthracene- and anthraquinone-disulphonic acids, acridine, benzoflavine, phenyl-2-methylquinoline, quinine, and probably aesculin. The following, however, had no accelerating effect: phenosafranine, fluorindindisulphonic acid, methylene-blue, harmalin, and also the following: tetranitrofluorescein, alizarin-blue hydrogen sulphite, and ethyl-red, which are without appreciable fluorescence.

It is also shown that the photochemical decomposition of Eder's solution proceeds more readily in a vacuum or in the presence of carbon dioxide or hydrogen than in the presence of oxygen.

J. J. S.

**Relations between Power of Absorption of Radiant Energy and Chemical Character.** ALFRED BYK (*Chem. Centr.*, 1905, ii, 6—7; from *Physikal. Zeit.*, 6, 349—353).—The original paper contains a comprehensive account of the relationship between the power of absorption of radiant energy and chemical and physical properties. In organic compounds, the OH and NH<sub>2</sub> groups appear even in the ultra-violet spectrum to play the part of an auxochrome, and the chromophoric character of double linkings is also apparent in this portion of the spectrum. The constitution of inorganic compounds is of less importance in optical phenomena. Increase of molecular weight of either organic or inorganic compounds has usually a bathochromic effect. The relations between atomic weight and spectra, and between electrical conductivity and non-selective absorption are also discussed.

E. W. W.

**Fundamental Principles of Three-colour Photography.** J. PRECHT and ERICH STENGER (*Chem. Centr.*, 1905, ii, 7; from *Physikal. Zeit.*, 6, 329—331).—The abstract contains a description of the theory of the three-colour photographic process which is mainly of a physical character. The energy required for the decomposition of silver bromide is conveyed by means of the dye, the chemical process being the same in the case of all the three colours, the dyes merely affecting the time of exposure. The eye can distinguish differences of shade up to 660 $\mu\mu$ , but the sensitiveness of the silver bromide plate decreases with enormous rapidity beyond 660 $\mu\mu$ . A dye is therefore required which has a maximum of sensitiveness at about 650 $\mu\mu$ .

E. W. W.

**Energy of Chemical Radiation through Three-colour Filters.** J. PRECHT and ERICH STENGER (*Chem. Centr.*, 1905, ii, 7—8; from *Physikal. Zeit.* 6, 332—334. Compare preceding abstract).—The density of a plate is proportional to the quantity of reduced silver, which is again proportional to the energy used in chemical action. The proportion of the latter to the whole energy radiated to the plate has been measured for the three-colour filters by physical methods which are described.

E. W. W.

**Radiation-sensitiveness of Silver Bromide Gelatin for White, Green, and Orange Light.** J. PRECHT and ERICH STENGER (*Chem. Centr.*, 1905, ii, 8; from *Physikal. Zeit.*, 6, 334—336. Compare preceding abstracts).—The relation between the energy received by radiation and the density of silver precipitates in ordinary silver bromide plates has been determined for white, green, and orange light. For the same density, the energy is about 250 times as great in green light as in white. For green and orange light, the relation is nearly the same for normal densities. When a quantity of energy



sufficient to produce a certain density is first imparted to the layer, then the gradation in the case of ordinary undyed silver bromide is very nearly the same for the same quantity of energy when white, green, or red light is employed for illumination. E. W. W.

**Effect of High Temperatures on the Rate of Decay of the Active Deposit from Radium.** HOWARD L. BRONSON (*Amer. J. Sci.*, 1905, [iv], 20, 60—64. Compare Curie and Danne, Abstr., 1904, ii, 306).—Temperatures between  $700^{\circ}$  and  $1100^{\circ}$  have very little, if any, effect on the rate of decay of the active deposit from radium. It may be assumed that radium *C* has the shorter rather than the longer of the two periods, and that radium *B* is the more volatile. The author's experiments indicate that 28 minutes and 21 minutes are too long for the decay periods of radium *B* and radium *C*, and that 26 minutes and 19 minutes are more nearly correct. J. C. P.

**New Radiation produced in Atmospheric Air by the Rays from Radiotellurium.** B. WALTER (*Ann. Physik*, 1905, [iv], 17, 367—374).—The author's experiments indicate the production in atmospheric air in contact with radiotellurium of a radiation with properties resembling those of ultra-violet light. The constituent of the atmosphere which is thus affected is pre-eminently the nitrogen. When other gases, such as carbon dioxide, nitrous oxide, coal gas, oxygen, and hydrogen, are in contact with the radiotellurium, the effect in question is very small. J. C. P.

**Radioactivation by means of Uranium.** HENRI BECQUEREL (*Compt. rend.*, 1905, 141, 87—90).—As has been shown previously, uranium *X* is precipitated, along with barium sulphate, from a solution of uranium chloride on addition of barium chloride and sulphuric acid. In the same manner, if water which has been exposed to radium emanation is treated with barium chloride and sulphuric acid, the barium sulphate obtained is radioactive, the rate of decay of the activity approximating to that of radium emanation, and the solution from which the emanation has been removed is inactive. It has been found possible to precipitate uranium *X* together with radium emanation: one-half of a solution of uranium chloride was exposed to radium emanation for some days, and both halves of the solution treated in the same manner with barium chloride and sulphuric acid. The barium sulphate from the solution which had been exposed to radium emanation was found 80 minutes after precipitation to be seven times as active as the sulphate from the unexposed solution. The excess of activity diminished at the rate of decay of radium emanation, and at the end of one day the activity of the barium sulphate from the exposed solution had diminished to slightly less than the activity of the sulphate from the standard. After the first day, the rate of decay, being due to uranium *X*, was the same for both sulphates.

The activity of uranium *X* which has been precipitated together with barium sulphate is not diminished when the sulphate is heated to bright redness in the oxyhydrogen blowpipe flame.

Uranium *X* is removed from uranium chloride solutions by boiling

with lampblack which has been washed with alcohol and ether. The precipitate from 5 grams of uranium chloride had an activity  $1/9$  of that of 1.32 grams of the black oxide of uranium. On igniting the active lampblack in a current of oxygen in a platinum crucible, a residue of inappreciable weight was obtained consisting of small fused grains which contained uranium, and had an activity six times that of the uncalcined lampblack. In eight days, the activity of the residue had increased to that of 1.32 grams of the black oxide of uranium.

In a similar experiment with 4 grams of lampblack and 150 grams of uranium chloride, the lampblack acquired an activity equal to half that of the standard black oxide. After ignition, the residue was treated with hydrochloric acid, and the undissolved substance, as well as the residue obtained on evaporation of the acid solution, was found to have an activity equal to that of the uncalcined lampblack.

Uranium chloride which has been boiled with lampblack is not capable of rendering a second sample active. If the active lampblack is thoroughly washed with cold dilute hydrochloric acid, the residue is only very slightly active. The inactive lampblack leaves no residue on ignition, the activity is therefore due to the precipitation of a solid, highly radioactive substance. G. Y.

**Relative Proportion of Radium and Uranium in Radioactive Minerals.** ERNEST RUTHERFORD and BERTRAM B. BOLTWOOD (*Amer. J. Sci.*, 1905, [iv], 20, 55—56. Compare Boltwood, this vol., ii, 295).—Comparative experiments on the activity of radium bromide and of a very pure sample of uraninite containing 74—75 per cent. of uranium lead to the conclusion that the quantity of radium associated with one gram of uranium in a radioactive mineral is approximately  $7.4 \times 10^{-7}$  gram. J. C. P.

**Radioactive Constituents of Wiesbaden Thermal Springs.** FERDINAND HENRICH and GÜNTHER BUGGE (*Zeit. angew. Chem.*, 1905, 18, 1011—1014. Compare this vol., ii, 6).—The deposit from the pipes of the Wiesbaden thermal springs, formerly examined, consisted mainly of aragonite and was radioactive, remaining so when heated at  $110^\circ$  for several hours. The gas evolved on the addition of hydrochloric acid was also radioactive. The deposit was separated into several fractions, and the radioactivity of each fraction examined. The radioactivity of the gas evolved from the Adler spring and of the water itself is due to radium emanation. A. McK.

**Mercury Arc Lamp with Quartz Jacket suitable for Chemical Purposes.** FRANZ FISCHER (*Ber.*, 1905, 38, 2630—2633).—This lamp consists of an exhausted double-walled quartz cylinder fixed with sealing-wax into the neck of a surrounding cylindrical glass vessel, which is connected with an air-pump. The anode consists of an iron ring, which surrounds the quartz cylinder and is suspended by means of two platinum wires fused into the walls of the glass vessel. Mercury is placed in the bottom of the latter to serve as cathode. Near the bottom of the glass vessel is an outer ring of tin foil connected with a copper wire so that an induction coil may be used

for lighting. The glass vessel dips into a small mercury trough into which the current is led.

Arrangements are made to cool the lamp both internally and externally, so that the temperature in the interior of the lamp is kept down, thus maintaining a low density of the mercury vapour, and favouring the formation of ultra-violet light. Figures of the lamp and accessory apparatus are given in the original. T. H. P.

**Concentration Cells in Liquid Ammonia.** HAMILTON P. CADY (*J. Physical Chem.*, 1905, 9, 477—503).—Concentration cells of the type sodium amalgam | sodium nitrate solution ( $c_1$ ) | sodium nitrate solution ( $c_2$ ) | sodium amalgam were constructed with liquid ammonia as solvent, the method of preparation being fully described. For this cell and a similar cell with sodium chloride, the *E.M.F.* was determined and compared with that given by the expression  $E = 0.000198 T \log c_1/c_2$ . The observed values are in most cases about 80 to 90 per cent. of those calculated, this difference being ascribable to the incomplete dissociation. Better agreement was obtained by the use of the formula  $E = 0.000198 T \log R_2/R_1$ , the ionic concentrations being inversely proportional to the resistances. Although the agreement is only approximate, it shows clearly the validity of a logarithmic expression, and that the laws for aqueous solution apply also to ammonia solution. Some cells with bivalent ions and sodium chloride cells without diffusion were also examined, accord with the estimated values being in these cases also fairly approximate. The *E.M.F.* of a cell having different amalgams as electrodes was also determined and found to be 1.42 times the calculated value; the similar ratio for a cell with pyridine as solvent is 1.41. The *E.M.F.* of three oxidation and reduction cells was also determined.

L. M. J.

**Iodine Titration Voltameter.** DAVID A. KREIDER (*Amer. J. Sci.*, 1905, [iv], 20, 1—10).—A new voltameter containing a strong solution of potassium iodide covered with a layer of dilute hydrochloric acid. On passing the current, iodine is liberated, the amount of which may be titrated, this being dependent on the strength of the current.

For further particulars the original article and illustrations should be consulted.

L. DE K.

**Cause of the Spontaneous Depression of the Cathode Potential in the Electrolysis of Dilute Sulphuric Acid.** JULIUS TAFEL and BRUNO EMMERT (*Zeit. physikal. Chem.*, 1905, 52, 349—373).—In continuation of previous work (Tafel, this vol., ii, 223) it is shown that when dilute sulphuric acid is electrolysed with a platinum anode, the current density at that electrode being comparatively low, chemically recognisable quantities of platinum are dissolved. These small quantities of platinum suffice to account for the depressions of the cathode potential previously observed, the sensitiveness of different cathode metals varying considerably. In



the case of a silver cathode, 0.0001 mg. of platinum is able to produce the depression of the potential for a cathode surface of 10 sq. cm. The effect is produced by the precipitation of the platinum on the cathode, but even then it may remain latent. The action of the platinum is apparently not to convert the cathode into a platinum cathode, but to assist catalytically some chemical change of the cathode surface. The action of gold on the cathode potential of other metals is insignificant compared with that of platinum. J. C. P.

**Electrolytic Potential of Chromous Salts (Electrochemical Equilibrium between Various Degrees of Oxidation).** II. ARRIGO MAZZUCHELLI (*Gazzetta*, 1905, 35, i, 417—448. Compare Abstr., 1902, ii, 119).—In investigating the conversion of chromic into chromous ions and *vice versa*, the author uses tin electrodes in mixtures of chromic and chromous chlorides, sulphates, fluorides, and acetates. Copper and mercury electrodes give varying results, and with these metals and also with tin higher potentials are obtained than with platinum. All the determinations were made in a stream of carbon dioxide. With two similar tin electrodes, differences up to 0.06 volt were obtained. On adding fresh chromic or chromous salt, the *E.M.F.* sometimes changes in the wrong direction at first, but afterwards assumes the normal value determined by the equation  $E = K - A \log(C^{III}/C^{II})$ . Similar irregularities are observed with platinum in hydrogen peroxide solution, but in this case the platinum acts catalytically, whilst tin has only a very small catalytic influence on chromous salts. For a mixture of chromic and chromous chlorides or acetates at 17—18°, with a normal  $Hg_2SO_4$  electrode, the constant  $K$  of the electrochemical equilibrium is 1.04—1.06 volts, whilst for the fluorides it has the value 1.17—1.19 volts. With the sulphates, less concordant values are obtained for the different solutions and electrodes, but the most probable value for  $K$  is 0.98—1.03 volts.

The following table gives the oxidation potentials of chromous-chromic salts and also those of ferrous-ferric salts, the values all being referred to the normal hydrogen electrode :

	Chlorides.	Sulphates.	Fluorides.	Acetates.
Iron .....	-0.705	-0.657	about -0.270	—
Chromium ...	+0.38	about +0.33	+0.51	+0.38

T. H. P.

**Boiling Points of Ammonia, Methylamine, Methyl Chloride, and Sulphur Dioxide.** HARRY D. GIBBS (*J. Amer. Chem. Soc.*, 1905, 27, 851—865).—A *résumé* is given of previous work on this subject, together with a criticism of the methods employed and the results obtained. An improved apparatus has been devised for the determination of these boiling points, and is described with the aid of a diagram. Special methods were employed for purifying the liquids. The boiling points of ammonia, methyl chloride, and sulphur dioxide were found to be -33.46°, -24.09°, and -10.09° respectively under 760 mm., whilst that of methylamine was found to be -6.7° under 755.67 mm. pressure.

E. G.

**Determination of Molecular Weight by Use of Solvents with High Boiling Points.** LEOPOLD RÜGHEIMER [with S. TOECHE MITTLER and E. RUDOLFI] (*Annalen*, 1905, 339, 297—310).—Instead of using the Beckmann method of determining molecular weights by the raising of the boiling point, it is found advisable to employ the lowering of vapour pressure, a method which can be adapted to solvents with boiling points above that of mercury. At the same time, the measurements can be made at any chosen pressures, and also at different temperatures. An exact description of the apparatus, the air-thermometers, and manometers, and of the method of using them is given in the paper.

K. J. P. O.

**Relation between the Logarithmic Temperature Constant and Heat Evolution.** JOH. PLOTNIKOFF (*Zeit. Elektrochem.*, 1905, 11, 389—390. Compare this vol., ii, 376).—Since  $d\log K/dT = q/RT^2 = \beta$ , it follows that  $q = \beta RT^2$ . Examples of the calculation of  $q$  are given, but the results are not compared with experimental values.

FRIEDRICH AUERBACH (*Zeit. Elektrochem.*, 1905, 11, 433—434) points out several errors in the above paper which are admitted by JOH. PLOTNIKOFF in a later communication (*ibid.*, 1905, 11, 434); the latter therefore withdraws the paper, with the exception of the above result.

T. E.

**Numerical Results of a Systematic Investigation of the Heats of Combustion and Formation of Volatile Organic Compounds.** JULIUS THOMSEN (*Zeit. physikal. Chem.*, 1905, 52, 343—348).—In the following list the heats of combustion given are subject to the condition that the products of combustion are gaseous carbon dioxide, nitrogen, sulphur dioxide, and chlorine, bromine, and iodine in the form of vapour and liquid water. The numbers given under  $p$  are heats of formation from amorphous carbon, rhombic sulphur, molecular gaseous hydrogen, nitrogen, chlorine, bromine, and iodine; the method of calculation and the fundamental figures used will be evident from the example of ethane, for which  $p = 2 \times 96.96 + 3 \times 67.49 - (370.44 - 5 \times 0.29) = 27.40$  Cal. The numbers given under  $p$  are referred to by the author as “empirical” heats of formation, because they refer to a special condition of carbon. In the column marked  $P$ , the values given are heats of formation from carbon atoms, &c.; these values are termed “absolute” heats of formation, and the relation between the values in the two columns is given by the equation  $P = p + a.38.38$ , where  $a$  is the number of carbon atoms in a molecule of the compound. Relationships between heat of formation and constitution are much more easily recognised from the “absolute” heats of formation than from the “empirical” heats of formation.

Substance.	Formula.	Heat of combustion at constant pressure.	Heat of or mation at constant volume.	
			<i>p.</i>	<i>P.</i>
<i>Hydrocarbons.</i>				
Methane .....	CH <sub>4</sub>	211.93	21.17	59.55
Ethane .....	C <sub>2</sub> H <sub>6</sub>	370.44	27.40	104.16
Propane .....	C <sub>3</sub> H <sub>8</sub>	529.21	33.37	148.51
Trimethylmethane .....	CH(CH <sub>3</sub> ) <sub>3</sub>	687.19	40.13	193.65
Tetramethylmethane .....	C(CH <sub>3</sub> ) <sub>4</sub>	847.11	44.95	236.85
Diisopropyl .....	(C <sub>3</sub> H <sub>7</sub> ) <sub>2</sub>	999.20	57.60	287.88
Benzene .....	C <sub>6</sub> H <sub>6</sub>	799.35	-13.67	216.61
Toluene .....	C <sub>7</sub> H <sub>8</sub>	955.68	-5.26	263.40
Mesitylene .....	C <sub>9</sub> H <sub>12</sub>	1282.31	-2.41	343.01
Pseudo-cumene .....	C <sub>9</sub> H <sub>12</sub>	1281.51	-1.59	343.83
Ethylene .....	C <sub>2</sub> H <sub>4</sub>	333.25	-3.29	73.47
Propylene.....	C <sub>3</sub> H <sub>6</sub>	492.74	+2.06	117.20
Trimethylene .....	C <sub>3</sub> H <sub>6</sub>	499.43	-4.63	110.51
<i>iso</i> Butylene .....	C <sub>4</sub> H <sub>8</sub>	650.62	+8.92	162.44
<i>iso</i> Amylene .....	C <sub>5</sub> H <sub>10</sub>	807.63	+16.65	208.55
Diallyl .....	C <sub>6</sub> H <sub>10</sub>	932.82	-11.58	218.70
Acetylene.....	C <sub>2</sub> H <sub>2</sub>	310.05	-47.77	28.99
Allylene .....	C <sub>3</sub> H <sub>4</sub>	467.55	-40.53	74.61
Dipropargyl.....	C <sub>6</sub> H <sub>6</sub>	882.88	-97.20	133.08

*Halogen Compounds.*

Methyl chloride .....	$\text{CH}_3\text{Cl}$	176.95	21.97	60.35
Ethyl chloride .....	$\text{C}_2\text{H}_5\text{Cl}$	334.11	29.55	106.31
Propyl chloride .....	$\text{C}_3\text{H}_7\text{Cl}$	492.38	36.02	151.16
<i>iso</i> Butyl chloride .....	$\text{C}_4\text{H}_9\text{Cl}$	650.09	43.05	196.57
Monochloroethylene .....	$\text{C}_2\text{H}_3\text{Cl}$	298.34	-2.46	74.30
Monochloropropylene .....	$\text{C}_3\text{H}_5\text{Cl}$	453.37	+7.25	122.39
Allyl chloride .....	$\text{C}_3\text{H}_5\text{Cl}$	454.68	+5.94	121.03
Chlorobenzene .....	$\text{C}_6\text{H}_5\text{Cl}$	763.88	-12.38	217.90
Ethylene chloride .....	$\text{C}_2\text{H}_4\text{Cl}_2$	296.36	+33.12	109.88
Ethylidene chloride .....	$\text{C}_2\text{H}_4\text{Cl}_2$	296.41	33.07	109.83
Chloroacetal .....	$\text{C}_3\text{H}_6\text{Cl}_2$	453.88	40.34	155.48
Carbonyl chloride .....	$\text{COCl}_2$	41.82	54.85	93.23
Chloroform .....	$\text{CHCl}_3$	107.03	23.53	61.91
Monochloroethylene chloride .....	$\text{C}_2\text{H}_3\text{Cl}_2$	262.48	32.82	109.58
Tetrachloromethane .....	$\text{CCl}_4$	75.93	20.45	58.83
Tetrachloroethylene .....	$\text{C}_2\text{Cl}_4$	195.07	-1.73	75.03
Methyl bromide .....	$\text{CH}_3\text{Br}$	184.71	+14.21	52.59
Ethyl bromide .....	$\text{C}_2\text{H}_5\text{Br}$	341.82	21.84	98.60
Propyl bromide .....	$\text{C}_3\text{H}_7\text{Br}$	499.29	29.11	144.25
Allyl bromide .....	$\text{C}_3\text{H}_5\text{Br}$	462.12	-1.50	113.64
Methyl iodide .....	$\text{CH}_3\text{I}$	196.08	2.84	41.22
Ethyl iodide .....	$\text{C}_2\text{H}_5\text{I}$	353.73	9.93	86.69

*Ethers, &c.*

Ethylene oxide .....	$(\text{CH}_2)_2\text{O}$	312.55	17.22	93.98
Methyl ether .....	$(\text{CH}_3)_2\text{O}$	349.36	48.19	124.95
Methyl ethyl ether .....	$\text{CH}_3 \cdot \text{O} \cdot \text{C}_2\text{H}_5$	505.87	56.42	171.56
Ethyl ether .....	$(\text{C}_2\text{H}_5)_2\text{O}$	659.60	67.43	220.95
Methyl allyl ether .....	$\text{CH}_3 \cdot \text{O} \cdot \text{C}_3\text{H}_5$	627.20	32.05	185.57
Allyl ether .....	$(\text{C}_3\text{H}_5)_2\text{O}$	911.10	9.85	240.13



Substance.	Formula.	Heat of combustion at constant pressure.	Heat of formation at constant volume.	
			<i>p.</i>	<i>P.</i>
<i>Ethers, &amp;c. (continued).</i>				
Methyl propargyl ether.. . . .	$\text{CH}_3 \cdot \text{O} \cdot \text{C}_3\text{H}_3$	603·83	-12·36	141·16
Anisole .....	$\text{CH}_3 \cdot \text{O} \cdot \text{C}_6\text{H}_5$	936·30	+13·83	282·49
Methylal .....	$\text{CH}_2(\text{O} \cdot \text{CH}_3)_2$	476·08	85·92	201·06
Trimethyl methenyl ether .....	$\text{CH}(\text{O} \cdot \text{CH}_3)_3$	599·18	127·27	280·79

*Alcohols.*

Methyl alcohol .....	$\text{CH}_3 \cdot \text{OH}$	182·23	50·58	88·96
Ethyl alcohol .....	$\text{C}_2\text{H}_5 \cdot \text{OH}$	340·53	57·02	133·78
Propyl alcohol... ..	$\text{C}_3\text{H}_7 \cdot \text{OH}$	498·63	63·66	178·80
<i>iso</i> Propyl alcohol .....	$\text{C}_3\text{H}_7 \cdot \text{OH}$	493·32	68·97	184·11
<i>iso</i> Butyl alcohol .....	$\text{C}_4\text{H}_9 \cdot \text{OH}$	658·49	68·54	222·06
Trimethylcarbinol .....	$\text{C}_4\text{H}_9 \cdot \text{OH}$	641·34	85·69	239·21
<i>iso</i> Amyl alcohol .....	$\text{C}_5\text{H}_{11} \cdot \text{OH}$	820·07	71·70	263·60
Dimethylethylcarbinol .....	$\text{C}_5\text{H}_{11} \cdot \text{OH}$	810·45	81·32	273·22
Allyl alcohol .....	$\text{C}_3\text{H}_5 \cdot \text{OH}$	464·76	29·75	144·89
Propargyl alcohol .....	$\text{C}_3\text{H}_3 \cdot \text{OH}$	431·10	-4·37	110·77
Phenol .....	$\text{C}_6\text{H}_5 \cdot \text{OH}$	768·76	+16·63	246·91
Ethylene glycol .....	$\text{C}_2\text{H}_4(\text{OH})_2$	298·11	99·15	175·91

*Aldehydes and Ketones.*

Acetaldehyde .....	$\text{CH}_3 \cdot \text{CHO}$	281·90	47·87	124·63
Propaldehyde .....	$\text{C}_2\text{H}_5 \cdot \text{CHO}$	440·72	53·79	168·93
<i>iso</i> Butaldehyde .. . . .	$\text{C}_4\text{H}_7 \cdot \text{CHO}$	599·90	59·31	212·83
Dimethyl ketone... ..	$(\text{CH}_3)_2 \cdot \text{CO}$	437·25	57·26	172·40
Methyl propyl ketone.. . . .	$\text{CH}_3 \cdot \text{CO} \cdot \text{C}_3\text{H}_7$	754·19	69·40	251·30

*Acids and Anhydrides.*

Formic acid .....	$\text{H} \cdot \text{CO}_2\text{H}$	69·39	95·35	133·73
Acetic acid .....	$\text{CH}_3 \cdot \text{CO}_2\text{H}$	225·35	104·13	180·89
Propionic acid .....	$\text{C}_2\text{H}_5 \cdot \text{CO}_2\text{H}$	386·51	107·71	222·85
Acetic anhydride.....	$(\text{C}_2\text{H}_3\text{O})_2\text{O}$	460·07	130·82	284·34

*Esters.*

Methyl formate .....	$\text{H} \cdot \text{CO}_2\text{CH}_3$	241·21	88·27	165·03
Methyl acetate.....	$\text{CH}_3 \cdot \text{CO}_2\text{CH}_3$	399·24	94·98	210·12
Ethyl formate .....	$\text{H} \cdot \text{CO}_2\text{C}_2\text{H}_5$	400·06	94·16	209·30
Methyl propionate .....	$\text{C}_2\text{H}_5 \cdot \text{CO}_2\text{CH}_3$	553·95	105·01	258·53
Ethyl acetate .....	$\text{CH}_3 \cdot \text{CO}_2\text{C}_2\text{H}_5$	546·57	112·39	265·91
Propyl formate .....	$\text{H} \cdot \text{CO}_2\text{C}_3\text{H}_7$	558·80	100·16	253·68
Methyl isobutyrate... ..	$\text{C}_3\text{H}_7 \cdot \text{CO}_2\text{CH}_3$	716·94	106·76	298·66
<i>iso</i> Butyl formate .....	$\text{H} \cdot \text{CO}_2\text{C}_4\text{H}_9$	719·90	103·80	295·70
Allyl formate .....	$\text{H} \cdot \text{CO}_2\text{C}_3\text{H}_5$	527·90	63·28	216·80
Dimethyl carbonate .....	$(\text{CH}_3)_2 \cdot \text{CO}_2$	357·57	136·86	251·50
Diethyl carbonate .....	$(\text{C}_2\text{H}_5)_2 \cdot \text{CO}_2$	674·10	149·31	341·21
Ethyl nitrate .....	$\text{C}_2\text{H}_5 \cdot \text{NO}_2$	324·04	38·75	115·51

Substance.	Formula.	Heat of combustion at constant pressure.	Heat of formation at constant volume.	
			<i>p.</i>	<i>P.</i>
<i>Sulphur Compounds.</i>				
Hydrogen sulphide.....	H <sub>2</sub> S	136·71	2·73	2·73
Methyl mercaptan .....	CH <sub>3</sub> ·SH	298·81	5·37	43·75
Ethyl mercaptan.....	C <sub>2</sub> H <sub>5</sub> ·SH	455·65	13·27	90·03
Dimethyl sulphide ...	(CH <sub>3</sub> ) <sub>2</sub> S	457·35	11·57	88·33
Diethyl sulphide..	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> S	772·17	26·23	179·75
Methyl thiocyanate.....	CH <sub>3</sub> ·S·NC	398·95	-31·99	44·77
Methyl thiocarbimide.....	CH <sub>3</sub> ·N·CS	392·06	-25·10	51·66
Allyl thiocarbimide.....	C <sub>3</sub> H <sub>5</sub> ·N·CS	675·36	-46·70	106·82
Thiophen .....	C <sub>4</sub> H <sub>4</sub> S	610·64	-15·58	137·94
Carbon disulphide .....	CS <sub>2</sub>	265·13	-25·43	12·95
Carbon oxysulphide .....	COS	181·01	+37·32	75·70

*Hydrogen Cyanide and Nitriles.*

Cyanogen .....	C <sub>2</sub> N <sub>2</sub>	259·62	-65·70	11·06
Hydrogen cyanide .....	HCN	158·62	-27·48	10·90
Acetonitrile .....	CH <sub>3</sub> ·CN	312·14	-16·26	60·50
Propionitrile.....	C <sub>2</sub> H <sub>5</sub> ·CN	471·45	-10·83	104·31

*Amines.*

Ammonia .....	NH <sub>3</sub>	90·65	11·31	11·31
Methylamine .....	CH <sub>3</sub> ·NH <sub>2</sub>	258·32	8·38	46·76
Dimethylamine .....	(CH <sub>3</sub> ) <sub>2</sub> NH	420·46	10·98	87·74
Trimethylamine .....	(CH <sub>3</sub> ) <sub>3</sub> N	582·63	13·55	128·69
Ethylamine ..	C <sub>2</sub> H <sub>5</sub> ·NH <sub>2</sub>	415·67	15·77	92·53
Diethylamine .....	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> NH	734·50	26·42	179·94
Triethylamine .....	(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> N	1052·38	38·02	268·30
Propylamine .....	C <sub>3</sub> H <sub>7</sub> ·NH <sub>2</sub>	575·74	20·42	135·56
<i>iso</i> Butylamine .....	C <sub>4</sub> H <sub>9</sub> ·NH <sub>2</sub>	725·36	35·56	189·08
Amylamine .....	C <sub>5</sub> H <sub>11</sub> ·NH <sub>2</sub>	890·58	35·08	226·98
Allylamine ..	C <sub>3</sub> H <sub>5</sub> ·NH <sub>2</sub>	531·28	-2·88	112·26
Aniline .....	C <sub>6</sub> H <sub>5</sub> ·NH <sub>2</sub>	838·47	-19·19	211·09
Pyridine .....	C <sub>5</sub> H <sub>5</sub> N	675·07	-20·53	171·37
Piperidine .....	C <sub>5</sub> H <sub>9</sub> ·NH <sub>2</sub>	833·79	+24·09	215·99

*Nitro-compounds and Nitrites.*

Nitromethane .....	CH <sub>3</sub> ·NO <sub>2</sub>	180·90	17·44	55·82
Nitroethane .....	C <sub>2</sub> H <sub>5</sub> ·NO <sub>2</sub>	337·94	25·14	101·90
Ethyl nitrite .....	C <sub>2</sub> H <sub>5</sub> ·O·NO	334·21	28·87	105·63
Amyl nitrite .....	C <sub>5</sub> H <sub>11</sub> ·O·NO	812·64	44·66	236·56
Ethyl nitrate .....	C <sub>2</sub> H <sub>5</sub> ·O·NO <sub>2</sub>	324·04	38·75	115·51

J. C. P.

**Contraction exhibited by Certain Substances on Ignition.**  
 RICHARD LUCAS (*Zeit. physikal. Chem.*, 1905, 52, 327—342).—The contraction exhibited by cobalt oxide, magnesia, kaolin, and zirconium oxide when heated to temperatures from 100° to 2000° has been studied. The substances named were made plastic with a little water or adhesive material, and used in the form of thin rods. It is found that the

more rapidly the temperature is raised the more marked is the contraction, although when the final temperature is very high the rate at which the temperature is raised is without effect. The contraction increases rapidly with the temperature to which the rods are exposed, and approaches an end value asymptotically. The relation between the extent of contraction and the time of ignition at a given temperature is expressible by a logarithmic formula, but for very high temperatures the influence of the time vanishes. For a rod placed in the furnace in a horizontal position, the linear contraction is greater in the vertical than in the horizontal direction, and the difference increases with rising temperature of ignition. The foregoing behaviour indicates the amorphous character of the substances used. The strength of the ignited rods rises rapidly with the temperature to which they have been exposed, and approaches an end value asymptotically. Contraction and porosity are intimately connected, and the result of heating is to diminish the volume of the hollow spaces within the porous substance; the contraction is brought about probably by capillary forces, heat diminishing the viscosity of the substances, and thereby diminishing their resistance to these forces. J. C. P.

**Osmotic Pressure and Freezing Points of Solutions of Sucrose.** HARMON N. MORSE and JOSEPH C. W. FRAZER (*Amer. Chem. J.*, 1905, 34, 1—99. Compare Abstr., 1902, ii, 553).—In continuing the work on the direct determination of osmotic pressure, it was found that suitable porous cells could not be obtained from the potteries, and it was therefore necessary to prepare them in the laboratory. A microscopic study has been made of thin sections of the walls of cells which had been tested previously with membranes in order to discover the peculiarities of texture which determine the suitability of a porous wall for this work. The essential qualities having been thus discovered, methods have been devised for the production of satisfactory cells.

A detailed account is given of the construction and calibration of the manometer used in determinations of osmotic pressure, and the various steps in the process of preparing the cell for use, including the deposition of the membrane. For particulars, the description and diagrams in the original must be consulted.

Considerable difficulty has been experienced owing to the temporary fluctuations of pressure resulting from changes of temperature, caused by the expansion or contraction of the liquids in the cell. In order to reduce these so-called "thermometer effects" as far as possible, the cell was placed in a specially devised box with double walls, the space between which was packed with hair felt.

A second source of error was encountered in the uncertainty regarding the true volume of that portion of the manometer, the form of which is affected by the sealing of the instrument; although this does not seriously affect the measurement of the pressure of dilute solutions, it becomes of considerable importance in the case of concentrated solutions.

A third difficulty is caused by the inversion of some of the sucrose in the cell. The amount of this inversion was determined by means



of Fehling's solution, but it is considered that the results thus obtained were below the actual quantity inverted, and it has therefore been decided to measure the inversion by means of the polariscope in future experiments.

Determinations have been made of the osmotic pressure of solutions of sucrose of various concentrations between 0.05 and 1.00 weight-normal, and from the results the molecular weight has been calculated by means of the formula  $M = W(22.488 + 0.0824t)/P$ , where  $P$  is the osmotic pressure at the temperature  $t$  of a weight  $W$  of the substance dissolved in 1000 grams of water. The molecular weights thus found vary between 327.9 and 347.7 and have an average value 341.2.

The results obtained in these experiments lead to the conclusion that sucrose dissolved in water exerts an osmotic pressure equal to that which it would exert if it were in the gaseous state at the same temperature and the volume of the gas were reduced to that of the solvent in the pure state.

Since the volume relations of solvent and solution play such an important part in the osmotic pressure of sucrose solutions, it was considered probable that the so-called abnormal freezing points at the higher concentrations may be dependent on, or related to, the degree of the distension of the solvent by the dissolved substance. The freezing points and density at 0°, or slightly below, at the various concentrations were therefore determined. From the results of these determinations certain relations have been deduced between the osmotic pressure and the depression of the freezing point.

In an earlier paper (Abstr., 1903, ii, 272), a list is given of a number of electrolytically deposited substances which exhibit considerable osmotic activity. The following compounds are also found to possess this property: ferric phosphate, stannous and nickel ferrocyanides, and the cobaltcyanides of cobalt, nickel, iron, copper, zinc, cadmium, and manganese.

E. G.

**Molecular Weights of Metallic Chlorides.** LEOPOLD RÜGHEIMER and E. RUDOLFI (*Annalen*, 1905, 339, 311—349).—The use of bismuth chloride as a solvent in determining the molecular weights of metallic chlorides has previously been described in a preliminary account (Abstr., 1903, ii, 725). The method now employed is that given in this vol., ii, 571. In addition to the earlier results, it has been found that molecules of salts in which two metallic atoms are linked together are of very rare occurrence. Only in the case of tin triethyl, which has the molecular formula  $\text{Sn}_2\text{Et}_6$ , is the double formula beyond doubt.

K. J. P. O.

**Molecular Weight of Bismuth Phosphate.** LEOPOLD RÜGHEIMER (*Annalen*, 1905, 339, 349—350. Compare preceding abstract).—Since the determination of the molecular weights of salts in solvents possessing a common anion gave good results, attempts were made to ascertain the molecular weight of bismuth phosphate in bismuth chloride, that is, the solvent and the solute having a common cation. The values found were 261.5 and 326.5, whereas  $\text{BiPO}_4$  requires 303.5. The phosphate is only sparingly soluble in the chloride.

K. J. P. O.

**Explosion Waves.** HAROLD B. DIXON (*Ber.*, 1905, 38, 2419—2446).—A lecture delivered before the German Chemical Society. G. Y.

**Reaction Velocity and Chemical Equilibrium in Homogeneous Systems and their Bearing on Cases of Enzyme Action.** ARIE W. VISSER (*Zeit. physikal. Chem.*, 1905, 52, 257—309. Compare this vol., ii, 511).—Formulæ are deduced for the velocities of mono-, di-, and tri-molecular reactions in cases where a point of equilibrium is reached short of complete change. The formula in the case of a uni-molecular reaction is  $\alpha = 1/t \cdot \log_e(C_0 - \beta)/(C - \beta)$ ;  $C_0$  is the initial concentration of the substance undergoing change,  $C$  its concentration after time  $t$ ;  $\alpha = k_1 + k_2$  and  $\beta = k_2 C_0 / (k_1 + k_2)$ , where  $k_1$  and  $k_2$  are the velocity-coefficients for the opposing reactions. The constant  $\beta$  is shown to be equal to the concentration at the equilibrium point of the substance which is undergoing change. The applicability of the author's formulæ is tested with satisfactory results by comparison with Schoorl's data on the formation of dextrose and galactose ureides (see Abstr., 1901, i, 258; 1902, i, 83). The velocity-coefficient in the case of mannose ureide (Schoorl, *loc. cit.*) has constant values whether determined from the dimolecular or the trimolecular formula.

The hydrolysis of sucrose by invertase and that of salicin by emulsin are regarded as reactions which proceed to an equilibrium point short of complete change, and the author accordingly applies the above-mentioned formulæ to these two cases. It is found that the velocity-coefficient increases in the first case, but diminishes in the second case, with the time; that is, the "intensity" of the catalyser varies with the concentration of the reacting substances, and the differential equation for the rate of hydrolysis of sucrose by invertase becomes, accordingly,  $-dC/dt = I[k_1 C - k_2(C_0 - C)^2]$ , where  $I$  is the intensity of the enzyme and a function of  $C$ . The actual variation of the intensity is obtained by dividing the course of the reaction into small stages, which are taken separately, and over which the velocity-coefficient may be regarded as constant; the value of the velocity-constant for such a short interval is then a measure of the enzyme intensity during that interval. In this empirical way, the author has traced the dependence of the enzyme intensity on the concentration of the reacting substances, and he finds for the hydrolysis of sucrose by invertase  $I = k_3(4C_0^2 + 2C_0 C + C^2)$ , and for the hydrolysis of salicin by emulsin  $I = k_3(4C_0^2 - 2C_0 C - C^2)$ . When these expressions are combined with the above differential equation it is possible to represent satisfactorily the course of change in each case.

From the reaction-coefficients it is possible to calculate the equilibrium constants, and the values of the latter so obtained agree with those deduced directly from the equilibrium conditions. The position of the equilibrium point is not affected by changing the concentration of the enzyme, but the velocity with which the point of equilibrium is approached is proportional to the concentration of the enzyme. The intensity of invertase falls off with increasing amounts of either sucrose or invert sugar. Over the temperature interval 0—25°, the reaction-coefficient for the hydrolysis of sucrose by invertase

is twice as great at  $T+10^{\circ}$  as at  $T$ . The displacement of the equilibrium by a rise of temperature from  $0-25^{\circ}$  is very small, in harmony with the fact that the heat effect of the reaction is very small.

The author has found that the activity of invertase and emulsin kept in sterilised solution remains quantitatively the same for several weeks.

J. C. P.

**Hydrolysis of Esters in Heterogeneous Systems.** HEINRICH GOLDSCHMIDT (*Zeit. Elektrochem.*, 1905, 11, 430—433).—Kremann (this vol., ii, 307) has investigated the hydrolysis of ethyl benzoate and of amyl acetate by sodium hydroxide in aqueous solution, and has drawn the conclusion that the reaction velocity observed is the velocity of solution of the ester. The author points out that this is not the case; the velocity of hydrolysis is comparatively small, so that the aqueous solution is always saturated with the ester. He shows in the case of ethyl benzoate that the velocity observed in the heterogeneous system may be calculated from the solubility of the ester and the velocity of hydrolysis obtained in a homogeneous solution. In the case of amyl acetate, the velocity constant changes gradually as hydrolysis progresses, but this is probably due to the amyl salt being a mixture of isomeric substances having different properties.

T. E.

**Autocatalytic Decomposition of Silver Oxide.** GILBERT N. LEWIS (*Zeit. physikal. Chem.*, 1905, 52, 310—326).—When silver oxide is kept at a steady temperature above  $300^{\circ}$ , the rate of decomposition is negligibly small at the start, but gradually increases to a maximum, falling off subsequently until the final disappearance of the oxide. When the oxide is previously mixed with metallic silver prepared from another portion of the same oxide, decomposition at the high temperature is at once appreciable, and the rate of decomposition reaches its maximum much sooner than when the oxide alone is taken. It appears, therefore, that the decomposition is catalytically accelerated by the silver which is formed. The rates of decomposition, however, of different samples of silver oxide differ markedly according to their source. Comparison of experiments made at  $327^{\circ}$ ,  $332.5^{\circ}$ ,  $352.2^{\circ}$ , and  $353.3^{\circ}$  with different portions of the same sample of oxide shows that the higher the temperature the greater is the maximum velocity of decomposition, and the shorter the period within which complete decomposition takes place. For a given temperature, it may be supposed that the reaction velocity at any moment is proportional to the quantity of oxide and also to the quantity of silver, that is,  $dx/dt = Kx(1-x)$ ; this may be transformed to  $dx/dt = Ke^{Kt}/(1+e^{Kt})^2$ , and the curve involved in the last equation corresponds very closely with the experimental curves in which velocity of decomposition is plotted against time. The rate of decomposition increases by about 50 per cent. for a rise of  $10^{\circ}$ .

It is suggested that the reaction which is catalytically accelerated is  $2O = O_2$ , and it is possibly this also which determines the rate of change in such reactions as the decomposition of potassium chlorate in presence of manganese dioxide and that of hydrogen peroxide in



presence of platinum. It is shown that the initial addition of platinum black to silver oxide has somewhat the same effect as the initial addition of silver; manganese dioxide also is found to accelerate the decomposition of silver oxide.

The thermostat used in these experiments, and recommended by the author, consisted of an enamelled bath filled with a mixture of potassium and sodium nitrates and surrounded by an asbestos shield. The regulator contained mercury, and the supply of gas to the heating burners was regulated by an electrical device. J. C. P.

## Inorganic Chemistry.

**Revision of the Atomic Weight of Iodine.** GREGORY P. BAXTER (*J. Amer. Chem. Soc.*, 1905, 27, 876—887. Compare Abstr., this vol., ii, 81).—The ratio of silver iodide to silver bromide and silver chloride has been determined by converting a weighed quantity of pure silver iodide into silver bromide by heating it in a quartz crucible in a current of air and bromine vapour and afterwards converting the silver bromide into the chloride by heating it in a stream of pure dry chlorine. From the ratio  $\text{AgI}:\text{AgBr}$ , obtained from the results of eight experiments made with four different samples of bromine, the atomic weight of iodine was found to be 126.985 ( $\text{Ag} = 107.93$ ;  $\text{Br} = 79.955$ ). A series of five determinations of the ratio  $\text{AgI}:\text{AgCl}$  gave the atomic weight of iodine 126.982, whilst from a second series of five determinations the value 126.984 was obtained ( $\text{Cl} = 35.473$ . Compare Richards and Wells, Abstr., this vol., ii, 451).

In the earlier paper (*loc. cit.*), determinations were made of the ratios of silver to silver iodide and iodine. The ratio of iodine to silver iodide has now been determined by dissolving a weighed quantity of carefully purified iodine in sulphurous acid and adding as nearly as possible the exact amount of pure silver dissolved in nitric acid. The liquid was tested for an excess of iodine or silver by means of the nephelometer, and the deficiency in either was adjusted until the faint opalescence produced both by hydriodic acid and silver nitrate was equal in both nephelometer tubes. It was found that, as already observed by Köthner and Auer (Abstr., this vol., ii, 81), if the silver nitrate is in excess it is liable to be occluded by the precipitated silver iodide, and in order to obviate this, very dilute solutions were employed and no excess of silver. From the ratio  $\text{Ag}: \text{I}$ , obtained from the results of eight determinations made with several different samples of iodine and three samples of silver, the atomic weight of iodine was found to be 126.987. Five determinations of the ratio  $\text{I}:\text{AgI}$  gave the atomic weight 126.983. In order to determine the ratio  $\text{Ag}:\text{AgI}$ , the filtrate and washings were evaporated to a small

bulk and the silver in the residue estimated by means of the nephelometer. The quantity of silver found was deducted from the original weight of silver and no correction was applied to the silver iodide for the amount dissolved in the washings. The results of four determinations with two samples of silver gave  $I = 126.989$ .

The average of the six series of experiments gave 126.985 for the atomic weight, and it is therefore probable that the results obtained in the earlier paper (*loc. cit.*) were slightly too low, owing to the occlusion of silver nitrate by the silver iodide.

The agreement of the results from silver bromide with those of the other series indicates that the value 79.955 obtained by Stas for the atomic weight of bromine is very nearly correct.

The results obtained by Köthner and Aeuer (*loc. cit.*) are discussed, and it is suggested that the value 126.936 for iodine ( $Cl = 35.45$ ;  $Ag = 107.93$ ) is probably too low and that this is due to the occlusion of traces of silver nitrate by the iodide and to an increase of weight in the apparatus during the experiment owing to the action of the hot halogens on the glass. A reply is given to the criticisms of Köthner and Aeuer (this vol., ii, 156) on the author's previous paper on this subject.

E. G.

**Formation of Ozone by Ultra-Violet Light.** FRANZ FISCHER and FRITZ BRAEHMER (*Ber.*, 1905, 38, 2633—2639).—Carefully dried and purified oxygen was subjected to the action of ultra-violet light from the mercury arc lamp described by Fischer (this vol., ii, 568). No ozone is formed at temperatures above  $270^{\circ}$  and the proportion of ozone in the issuing stream of gas is increased by augmenting the amount, or lowering the temperature, of the cooling water employed. Increase of the intensity of the light causes the proportion of ozone obtained to rise to a maximum and then fall somewhat, probably owing to appreciable decomposition of the ozone by a rise in temperature. By doubling the rate of flow of the oxygen, the absolute amount of ozone formed by the lamp is nearly doubled, although the percentage of ozone in the issuing gas is reduced to about 0.8 of its initial value. The fact that the odour of ozone emitted by Heraeus' quartz-mercury lamp diminishes considerably in intensity soon after the lighting of the lamp is due to the rise in temperature. T. H. P.

**Amorphous Sulphur. II. Two Liquid States of Aggregation of Sulphur,  $S_{\lambda}$  and  $S_{\mu}$ , and their Transition Point.** ALEXANDER SMITH, WILLIS B. HOLMES, and ELLIOT S. HALL (*J. Amer. Chem. Soc.*, 1905, 27, 797—820. Compare *Abstr.*, 1903, ii, 139, 284; this vol., ii, 382).—Most of the results of the work described in this paper have been published previously.

When melted rhombic sulphur is heated, viscosity first appears at  $159.5^{\circ}$ . The absorption of heat connected with the transition occurs at  $162.5^{\circ}$  and upwards, the liquid becoming viscous at the same moment. Distilled sulphur behaves somewhat differently from crystalline sulphur and appears to be much more liable to become superheated; the viscosity is first apparent at  $161.5$ — $162^{\circ}$  and even then asserts itself rather gradually. These phenomena take place in the same way and at the same temperature whether the sulphur

employed is such as by chilling gives insoluble sulphur, or whether it does not do so owing to its having been treated with ammonia.

The coefficients of expansion of sulphur for short intervals of temperature from  $154^{\circ}$  to  $170^{\circ}$  have been determined. An experiment is described in which the separation of the two phases, yellow and brown liquid sulphur, may be observed.

E. G.

**Measurements of Equilibrium in the Contact Process of preparing Sulphur Trioxide.** MAX BODENSTEIN and WILHELM POHL (*Zeit. Elektrochem.*, 1905, 11, 373—384).—The mixture of air or oxygen and sulphur dioxide was passed over platinum sponge contained in quartz glass tubes and heated in an electric tube furnace. Two tubes were employed, in the first of which the greater part of the reaction occurred; the second was jacketed by a thick silver vessel which served to equalise the temperature and contained a thermo-element; in it equilibrium was completely attained at a definitely known temperature. By keeping the temperature of the first tube higher or lower than that of the second, equilibrium could be attained from both directions. The constant  $K = \frac{[\text{SO}_2]^2 \cdot [\text{O}_2]}{[\text{SO}_3]^2}$  was determined at  $727^{\circ}$  for mixtures in which the ratio  $2\text{SO}_2 : \text{O}_2$  varied from 0.21 to 3.97; its value was found to be independent of this ratio and also of the quantity of nitrogen present. The following are the most important numerical results obtained:

Temperature.	K.	Q (cals.).
528	$1.55 \times 10^{-5}$	
579	$7.55 \times 10^{-5}$	21,300
627	$3.16 \times 10^{-4}$	22,500
680	$1.12 \times 10^{-3}$	21,800
727	$3.54 \times 10^{-3}$	21,500
789	$1.26 \times 10^{-2}$	21,700
832	$2.80 \times 10^{-2}$	21,700
897	$8.16 \times 10^{-2}$	21,100

The values of Q are calculated from those of K; they agree well with Berthelot's thermochemical result,  $\text{SO}_2 \text{ gas} + \text{O} = \text{SO}_3 \text{ gas} + 22,600 \text{ cals.}$  at the ordinary temperature.

T. E.

**Oxidation of Atmospheric Nitrogen by the Aid of the Electric Arc.** FRANZ VON LEPEL (*Ber.*, 1905, 38, 2524—2533).—A continuation of work previously published (*Abstr.*, 1903, ii, 420; 1904, ii, 251, 725). The apparatus used by the author for the oxidation of atmospheric nitrogen by the electric arc is described in detail. The influence of metallic salts distributed on the cathode in small amount on the yield was examined. The influence of the amount of air admitted into the oven and of the shape of the oven were examined and the results quoted in tabular form.

A. McK.

**Reactions in Liquid Ammonia.** EDWARD C. FRANKLIN (*J. Amer. Chem. Soc.*, 1905, 27, 820—851. Compare Franklin and Kraus, *Abstr.*, 1900, ii, 382; Franklin and Stafford, 1902, i, 748).—Attention is drawn to the striking resemblance between the physical properties of water and liquid ammonia. Emphasis is laid on the analogy between



the relations of the acid amides, the metallic amides, and the metallic derivatives of the acid amides to ammonia, and the relations of the ordinary oxygen acids, bases, and salts to water, and a system of nomenclature for the former class of derivatives is suggested. It is proposed that ammonia derivatives which bear to ammonia the relation which ordinary salts, bases, and acids bear to water should be termed ammono-salts (for example, potassium acetamide), ammono-bases (metallic amides, imides, and nitrides), and ammono-acids (acid amides, imides, and nitrides). The term "ammonolysis" is suggested for the designation of a class of reactions in which ammonia plays a part analogous with that of water in hydrolysis. The so-called mercuri-ammonium compounds are classified as (1) compounds related to ammonia as ordinary basic compounds are related to water, such as the infusible white precipitate,  $\text{NH}_2\text{HgCl}$ ; (2) salts with ammonia of crystallisation, such as the fusible white precipitate,  $\text{HgCl}_2 \cdot 2\text{NH}_3$ ; and (3) mixed compounds containing residues basic to both ammonia and water, such as the compound  $2\text{HgO} \cdot \text{NH}_3$ , prepared by the action of ammonia on mercuric oxide.

Experiments are described which were undertaken to ascertain if new metallic amides, imides, or nitrides could be obtained by metathetic reactions between potassamide and salts of other metals in solution in liquid ammonia. *Silver amide*,  $\text{AgNH}_2$ , obtained as a white precipitate when a solution of potassamide is added to an excess of silver nitrate solution, is soluble in solutions of ammonium salts, darkens on exposure to light, and when dry forms dark masses which readily explode with great violence. *Mercuric nitride*,  $\text{Hg}_3\text{N}_2$ , obtained as a chocolate-coloured precipitate on adding a solution of mercuric iodide or bromide to an excess of potassamide solution, is readily soluble in solutions of ammonium salts in liquid ammonia or in aqueous acids and is very explosive.

*Ammono-basic mercuric iodide* (mercuric idonitride, dimercuri-ammonium iodide),  $\text{NHg}_2\text{I}$ , prepared by adding potassamide solution to excess of mercuric iodide dissolved in liquid ammonia, forms a reddish-yellow precipitate which is soluble in ammonia solutions of ammonium salts, and by the further action of potassamide is converted into mercuric nitride; when heated in a closed tube, it decomposes without exploding into mercury and mercuric iodide.

*Ammono-basic mercuric bromide* (mercuric bromonitride, dimercuri-ammonium bromide),  $\text{NHg}_2\text{Br}$ , obtained as a yellow precipitate by treating a solution of mercuric bromide with a solution of potassamide, is soluble in ammonia solutions of ammonium salts or in aqueous acids, and is converted by potassamide into mercuric nitride.

When mercuric chloride is brought into contact with liquid ammonia, the compound  $\text{HgCl}_2 \cdot 12\text{NH}_3$  (Franklin and Kraus, *loc. cit.*) is obtained, which is but slightly soluble in liquid ammonia; at the ordinary temperature, it loses ammonia and becomes converted into the fusible white precipitate,  $\text{HgCl}_2 \cdot 2\text{NH}_3$ . By the action of ammonia on mercuric chloride, a small quantity of ammono-basic mercuric chloride (the infusible white precipitate),  $\text{NH}_2\text{HgCl}$ , is also formed; this compound is also produced by the action of sodamide on an excess of mercuric chloride.

When potassamide is added to a solution of lead nitrate in liquid ammonia, a white basic salt is first precipitated, but on increasing the quantity of potassamide, the precipitate becomes orange-red, and dissolves if an excess of potassamide is added; similar reactions occur between potassamide and lead iodide. *Lead imide*,  $\text{PbNH}$ , may be prepared by adding lead iodide solution gradually to a solution of potassamide until a considerable quantity of the orange-red precipitate has been produced, and leaving the precipitate in contact with the liquid for 24 hours. The product thus obtained, when dry, forms a reddish-brown, dense, amorphous mass and is very explosive.

*Ammono-basic lead iodide*,  $\text{NPb}_3\text{I}_2\text{NH}_3$ , obtained by adding potassamide solution to a solution of lead iodide and shaking the mixture as long as the lead iodide is in excess, forms a white precipitate which, on heating, loses ammonia and gradually darkens in colour and is not explosive.

When a solution of bismuth iodide or bromide in liquid ammonia is added to a solution of potassamide, *bismuth nitride*,  $\text{BiN}$ , is obtained as a brown precipitate.

On the addition of excess of aluminium iodide to a potassamide solution, a white precipitate of an ammono-basic product is formed. By the action of potassamide solution on the product formed by treating antimony iodide with ammonia, a substance is obtained which probably consists of impure antimony nitride.

E. G.

#### Properties of Mixtures of Nitric and Sulphuric Acids. IV.

A. V. SAPOSCHNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 374—381. Compare Abstr., 1904, ii, 614).—The author has examined mixtures of nitric acid of sp. gr. 1.40 and sulphuric acid by the methods previously described (Abstr., 1904, ii, 251). The vapour pressure of the nitric acid alone is 1.9 mm. of mercury, and it rises to a maximum of 23.43 mm. for a mixture containing 60.16 per cent. of sulphuric acid, falling to 0.66 mm. when the percentage of sulphuric acid present is 89.94. The proportion of nitrogen in the vapour is 19.3 per cent. for nitric acid of sp. gr. 1.40, this corresponding with the composition  $2\text{HNO}_3, \text{H}_2\text{O}$ ; when 5 per cent. of sulphuric acid is present, the amount of nitrogen in the vapour rises to 22.45 per cent., corresponding with the composition  $\text{HNO}_3$ , and this number is practically unchanged by subsequent additions of sulphuric acid.

The sp. gr. of the acid mixtures increases regularly with the proportion of sulphuric acid present until the latter reaches 90 per cent.; more sulphuric acid than this conditions a slight fall in the sp. gr. The specific conductivity falls regularly as the percentage of sulphuric acid rises from 0 to 70; beyond this a slight rise occurs, followed by a rapid fall to zero.

The properties of nitric acids of different concentrations were examined with the following results:

Sp. gr. at 15°/4°.	Percentage composition		Vapour pressure of the nitric acid at 25°.	Percentage nitrogen in the vapour.
	HNO <sub>3</sub> .	H <sub>2</sub> O.		
1·5100	98	2	46·2 mm.	23·75
1·4970	92·93	7·07	42·6 "	23·5
1·487	88·65	11·35	29·7 "	23·05
1·462	82·10	17·90	16·64 "	22·62
1·453	78·10	21·90	9·40 "	22·52
1·400	65·30	34·70	1·90 "	19·32

T. H. P.

**Supposed Volatility of Silicon Dioxide at the Moment of its Liberation by Strong Acids.** CARL FRIEDHEIM and ALFRED PINAGEL (*Zeit. anorg. Chem.*, 1905, 45, 410—411).—The deficiency of silicon dioxide in the analyses of silicates noticed by Kehrman (*Zeit. anorg. Chem.*, 39, 48) and Flürscheim (*Zeit. anorg. Chem.*, 39, 106) is attributed to experimental error.

D. H. J.

**The Decomposition of Potassium Chlorate by Hydrochloric Acid; a Reaction of the First Order.** E. DAVIDSON (*Zeit. angew. Chem.*, 1905, 18, 1047—1054).—In the absence of oxygen, the reaction between potassium chlorate and hydrochloric acid is unimolecular. The reaction-coefficient is independent of the concentration of the potassium chlorate.

An increase of temperature accelerates the action, as also does the presence of potassium iodide. The rate of decomposition of the chlorate can be measured only when the hydrochloric acid is in considerable excess, and increases when the amount of hydrochloric acid present is increased.

A. McK.

**Causticising Potassium Sulphate.** IGNAZ HEROLD (*Zeit. Elektrochem.*, 1905, 11, 417—430).—The reaction between potassium sulphate and calcium hydroxide is studied. The equilibrium constant  $k = [\text{OH}]^2/[\text{SO}_4^{''}]$  is easily shown to be the same as the ratio between four times the cube of the solubility of calcium hydroxide and the square of the solubility of calcium sulphate, provided that both salts are present in the solid condition and that they are supposed to be completely dissociated in their saturated solutions. The solubility of calcium hydroxide at high temperatures is determined by heating water with excess of lime in a steel tube, across the middle of which a partition of several layers of very fine platinum gauze is stretched. By inverting the tube, the saturated solution can be filtered under pressure. The following results are obtained expressed in grams of CaO per litre of saturated solution:

Temperature.	Solubility.
120°	0·305
150	0·169
190	0·084

The equilibrium constants calculated from the solubilities do not agree with those found directly, which is probably due to a rapid



diminution of the dissociation of calcium hydroxide at high temperatures. The compositions of the solutions in equilibrium with calcium hydroxide and calcium sulphate are determined at five temperatures from 0° to 190°. At any one temperature, the values of the ratio  $[\text{OH}]^2/[\text{SO}_4]$  diminish as the concentrations of the dissolved salts increase, whilst the effect of increase of temperature is first to diminish the ratio and then to increase it, the minimum being found at about 100°. The ratio of the concentrations of the ions cannot be calculated for lack of data.

Below 100°, potassium calcium sulphate is formed when the concentration of the dissolved salts is increased; the third solid phase thus introduced causes the composition of the solution to become constant.

The bearing of the results on the manufacture of potassium hydroxide is then considered.

T. E.

### Sodium Perborate. Hydrogen Peroxide in Statu Nascendi.

GEORGE F. JAUBERT (*Chem. Centr.*, 1905, ii, 99—100; from *Rev. gen. Chim. pure appl.*, [vii], 8, 163—167).—The original paper contains a description of the therapeutic application of hydrogen peroxide. The preparation of pure solutions of hydrogen peroxide appears to be most readily effected by means of sodium perborate (*Abstr.*, 1905, ii, 26).

[With GASTON LION.]—Sodium perborate may be obtained from its solution in water in the form of rather voluminous, lustrous prisms. One litre of water dissolves about 25.5 grams at 15°, 26.9 at 21°, 28.5 at 26°, and 37.8 at 32°. The aqueous solution is distinctly alkaline, and with potassium permanganate behaves like hydrogen peroxide. At temperatures above 40°, the solution decomposes and oxygen is liberated, but the loss is not great if the temperature does not rise above 60°. Small quantities of magnesium sulphate or ammonium sulphate increase the solubility of the salt, and by adding acids still more concentrated solutions of hydrogen peroxide may be obtained. For technical purposes, sulphuric acid is used, and solutions containing 30 or more vols. are produced.

E. W. W.

**Preparation of Rubidium and Cæsium.** L. HACKSPILL (*Compt. rend.*, 1905, 141, 106—107).—Rubidium and cæsium are prepared by heating a mixture of 3 grams of calcium, broken in small pieces, with 12 grams of fused anhydrous rubidium or cæsium chloride respectively in a wide, V-shaped glass tube at the bend of which is fused a vertical tube connected with a Sprengel pump. The reduction commences at 400—500°, and takes place with sufficient development of heat to volatilise the alkali metal, which is collected and sealed off in the vertical tube. This method is more rapid and gives better yields (10 grams) than the reduction of the alkali hydroxide by means of aluminium or magnesium filings. Lithium chloride is reduced by calcium at a slightly higher temperature; so far, there has been obtained only an alloy of calcium and lithium, from which the latter could not be isolated.

G. Y.

**Decomposition of Ammonium Nitrite in Aqueous Solution and Analogous Changes.** WILHELM BILTZ and WILLY GAHL (*Zeit. Elektrochem.*, 1905, 11, 409—413).—Previous investigators have

employed solutions of ammonium nitrite containing other salts; in order to avoid possible complications due to these salts, solutions of pure ammonium nitrite were heated and the rate of evolution of nitrogen measured. The velocity of the reaction is represented about equally well by the equations of the reactions of the first and second order. By means of van't Hoff's method of comparing the velocities at two different concentrations, it is shown that the reaction is really of the second order. The authors take the view that the change takes place between ammonium nitrite and nitrous acid produced by hydrolysis.

The decomposition of ammonium percarbonate is also investigated. It may be represented by the equation of the unimolecular reaction, although van't Hoff's method shows it to be bimolecular. T. E.

**Colloidal Salts. I. Silver Salts.** ALFRED LOTTERMOSER (*J. pr. Chem.*, 1905, [ii], 72, 39—56. Compare Abstr., 1904, ii, 31).—Colloidal silver chloride, bromide, iodide, thiocyanate, cyanide, hydroxide, carbonate, chromate, sulphide, phosphate, arsenate, ferrocyanide, and ferricyanide may be formed by adding a silver nitrate solution to the solution of the alkali or hydrogen salt, keeping the hydrosol-forming anion in excess, or reversely keeping the silver ion in excess. No hydrosol formation could be observed by the interaction of silver nitrate and hydrocyanic acid. For each case there is a definite maximum limit of concentration, which is greater for the first than for the second method of formation. The silver salt is precipitated in the "molecular" state if the limit of concentration is exceeded or in presence of an excess of the added solution; this precipitation takes place most sharply with the silver haloids. G. Y.

**Effect of Silver Nitrate on the Solubility of Silver Nitrite.** RICHARD ABEGG and H. PICK (*Ber.*, 1905, 38, 2571—2574).—The numbers obtained by Naumann and Rücker (this vol., ii, 522) for the solubility product  $\text{Ag}^+ \times \text{NO}_2^-$  in the presence of silver nitrate are not constant owing to the fact that the authors have assumed that in a saturated solution of the nitrite all the molecules are ionised. It is now shown that at 25° only 55 per cent. of the nitrite is ionised, and if this is taken into consideration the solubility product for the pure nitrite =  $2.1 \times 10^{-4}$ , and it retains the same value in the presence of varying amounts of silver nitrate. At 18°, a value  $1.8 \times 10^{-4}$  has been obtained for the product. J. J. S.

**Decomposition of Zinc Carbonate by Solutions of Alkali Chlorides.** H. CANTONI and J. PASSAMANIK (*Ann. Chim. anal.*, 1905, 10, 258—262. Compare Abstr., 1904, ii, 334; 1905, ii, 87, 115).—Tables are given showing the action of ammonium, potassium, and sodium chlorides in aqueous solutions on zinc carbonate at different temperatures and periods of action. Experiments with cadmium carbonate are also communicated.

The action of ammonium chloride differs essentially from the other chlorides as it increases very notably with the temperature.

L. DE K.

**Co-ordinates of the Melting-point Curve, Change of Volume and Heat of Crystallisation of  $\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$  in Relation to Pressure.** NICOLAI A. PUSCHIN (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 382—392).—The author has determined the melting point of  $\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$  at various pressures by the method given by Tammann (*Kristallisieren und Schmelzen*, 1903, 251—263), the results obtained being expressed by the formula:  $t = 58.7^\circ + 0.00813p - 0.0000005p^2$ . This expression indicates that the maximum of the melting-point curve lies at about 8000 kilos. pressure and  $91^\circ$ ; the value of  $dT/dp$  (or  $\Delta v$ ) will there pass through zero and subsequently become negative, so that solidification will be accompanied by increase of volume.

The heat of crystallisation of  $\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$  is found calorimetrically to have the mean value 26.3 Cals. at the ordinary pressure. The author's results satisfy the formula of Clausius, namely,  $dT/dp = T\Delta v/R$ .  
T. H. P.

**Spectrographic Investigations of the Urbain-Lacombe Method for the Separation of Samarium, Europium, and Gadolinium.** G. EBERHARD (*Zeit. anorg. Chem.*, 1905, 45, 374—384).—A spectrographic test of the efficiency of the Urbain-Lacombe method (*Abstr.*, 1904, ii, 37, 173, 340; this vol., ii, 250) was made with specimens furnished by Urbain himself. The results obtained show that (1) a quantitative separation of europium from samarium is possible by the method, and it forms a good means of preparing pure europium, samarium free from europium, and gadolinium free from samarium. (2) There is no evidence of a fractionation of samarium into simpler constituents. (3) Urbain's value of the atomic weight of samarium (150.34 with  $\text{O} = 16$ ) is to be regarded as correct since his material was spectroscopically pure. (4) The atomic weight alone cannot serve as a test of the purity of a samarium preparation; Bettendorff found an atomic weight of 150.1, although his preparation was contaminated with a large proportion of gadolinium and with small proportions of neodymium, europium, and yttrium. (5) Gadolinium, even when it yields a white oxide, may still contain small quantities of coloured earths which can be detected spectroscopically.

The conclusions arrived at differ in essential particulars from those obtained by Crookes (this vol., ii, 250, 392). It is suggested that the experimental error in his experiments, due to optical errors of the spectrometer, is greater than Crookes supposes.  
D. H. J.

**Tensile Strength of Copper-Tin Alloys.** E. S. SHEPHERD and G. B. UPTON (*J. Physical Chem.*, 1905, 9, 441—476).—The freezing-point curve of alloys containing more than 50 per cent. copper is given. This shows equilibria fields for the following crystals:  $\alpha$  and liquid,  $\beta$  and liquid,  $\gamma$  and liquid. At lower temperatures below the line at which solid alone exists, fields of equilibrium of  $\alpha$ ,  $\alpha + \beta$ ,  $\beta$ ,  $\beta + \gamma$ ,  $\gamma$ ,  $\alpha + \delta$ ,  $\delta$ ,  $\delta + \text{Cu}_3\text{Sn}$ ,  $\text{Cu}_3\text{Sn} + \epsilon$ , are plotted. The only compound existent is  $\text{Cu}_3\text{Sn}$ , the other crystals being solid solutions. The effect of heat treatment of various kinds on the tensile strength and ductility of the alloys has been investigated, and a full account of the method of testing and of the preparation of test pieces is given. Curves of



tensile strength are given. Until 87 per cent. copper is reached there is practically no effect due to heat treatment, as at all temperatures the stable form is the  $\alpha$ -crystal. From 87 to 76 per cent. heat treatment has a marked effect; thus alloys annealed at  $400^{\circ}$  consist of  $\alpha$ - and  $\delta$ -crystals, whilst those annealed at  $540^{\circ}$  and quenched at a red heat consist of  $\alpha$ - and  $\beta$ -crystals and possess a much greater tensile strength. This is very marked at 78 per cent. copper, which when water-quenched at a red heat possesses double the strength of that kept for a week at  $400^{\circ}$ . In alloys possessing no  $\alpha$ -crystals, the tensile strength is very small, and the strongest bronzes are those containing 78 to 81 per cent. copper and consisting of mixtures of  $\alpha$ - and  $\beta$ -crystals. When tested as cast, the ductility decreases with decreasing copper content, and heat treatment may increase the ductility very greatly even when it has no effect on the tensile strength; this is especially marked in alloys of 88—90 per cent. copper, for which the ductility may be increased almost four-fold.

L. M. J.

**Preparation of Binary Compounds of Metals by the Aluminothermic Method.** CAMILLE MATIGNON and R. TRANNOY (*Compt. rend.*, 1905, 141, 190. Compare Colani, this vol., ii, 525).—The authors have prepared phosphides, arsenides, silicides, and borides by means of reduction with aluminium and are able to confirm Colani's results (*loc. cit.*).

The phosphides of copper, manganese, iron, and nickel are prepared from the phosphates mixed with the corresponding oxide. The arsenides are obtained similarly from the arsenates. Silicides of manganese, chromium, copper, nickel, cobalt, and iron are formed by inducing the reaction in the strongly heated mixture of metallic oxide, silica, and aluminium.

Manganese boride, formed from boric anhydride and manganese oxide mixed in the proportion Mn : B, is obtained as a mass of needles. Boride of iron prepared in the same manner consists of prismatic needles and is extremely difficult to fracture.

In these preparations, in order to obtain the product well separated from the gangue, the initial temperature of the reaction must be about  $1000^{\circ}$ .

G. Y.

**Aluminium-Zinc Alloys.** E. S. SHEPHERD (*J. Physical Chem.*, 1905, 9, 504—512).—The specific volume curve for alloys of aluminium and zinc, although it does not diverge greatly from the straight line, consists of two branches which meet at about the composition 50 per cent. aluminium. This indicates the probability that the composition of the phases is approximately pure zinc and a solid solution of zinc in aluminium with a limiting concentration of about 50 per cent. (Care was taken to ensure that the specimens employed had actually reached equilibrium.) Microscopic examination of the alloys confirms the view of the existence of this solution, so that from these results and those of Heycock and Neville on the freezing point the author considers it established that in this series of alloys there are no definite compounds but that two series of solid solutions occur: (1) zinc in aluminium with a limiting concentration of about 50 per cent. zinc,

and (2) aluminium in zinc with a limiting concentration of about 4 per cent. aluminium, these limits being for the temperature  $217^{\circ}$ . An equilibrium diagram illustrative of these views is given.

L. M. J.

**Ultramarine.** KARL A. HOFMANN and W. METZNER (*Ber.*, 1905, 38, 2482—2486).—Ultramarine is not altered by digestion at the laboratory temperature with 98.5 per cent. sulphuric acid, or with fuming sulphuric acid, or with a mixture of nitrosylsulphuric and fuming sulphuric acids. On digestion with 93 per cent. sulphuric acid, a change in the colour of ultramarine is observable in twelve hours, with 89 per cent. acid in three hours, and with 65 per cent. acid in five seconds, the ultramarine being completely decolorised on digestion with the last acid for one hour.

The composition of ultramarine is not altered on digestion at the laboratory temperature with (a) a mixture of glacial acetic acid and acetic anhydride, (b) glacial acetic acid and acetic anhydride saturated with hydrogen chloride or bromide, (c) a solution of bromine in glacial acetic acid and acetic anhydride, or (d) aqueous sodium hydroxide. With acetic acid containing water, decolorisation takes place more quickly than with sulphuric acid containing the same percentage of water. After repeated washing with a solution of hydrogen bromide in acetic acid, the ultramarine residue is found to contain a diminished proportion of sodium and aluminium oxides.

Alkali polysulphides and thiosulphates are decomposed immediately by acetic acid, acetic anhydride, concentrated or fuming sulphuric acid, or a mixture of fuming sulphuric acid and fuming nitric acid, which has no action on ultramarine.

The authors consider ultramarine to be an analogue of Weber's sulphur sesquioxide,  $S_2O_3$ .

G. Y.

**Changes of Colour caused by the Action of Certain Rays on Glass.** SAMUEL AVERY (*J. Amer. Chem. Soc.*, 1905, 27, 909—910).—It has been observed by Crookes (*Chem. News*, 1905, 91, 73) that certain glass from South America containing manganese becomes violet on exposure to the sun's rays. The author has obtained samples of glass from New Mexico which were intensely coloured, a bottle partly buried showing the greatest change of colour where most exposed to sunlight. Different samples which had been probably exposed for several years showed a depth of colour approximately proportional to the amount of manganese present. The sand from New Mexico was not radioactive and the change was therefore not due to radium. Similar phenomena have been observed by Fischer (this vol., ii, 320) with ultra-violet rays from a mercury vapour lamp.

E. G.

**The Action of Slightly Alkaline Waters on Iron.** CECIL H. CRIBB and FRANCIS W. F. ARNAUD (*Analyst*, 1905, 30, 225—237).—The authors find that when the alkalinity of a softened water exceeds a certain limit, the water has no action whatever on bright iron surfaces. With an alkalinity not exceeding a certain amount (dependent on the nature of the alkali present, and, to a less extent, on the temperature), the corrosive action may be equal in intensity to

that which would occur in the absence of any alkali. The hydrogen peroxide theory (Dunstan, *Proc.*, 1903, **19**, 150) and the carbon dioxide theory (Moody, *Proc.*, 1903, **19**, 157 and 239) are not considered by the authors to explain the corrosive action of these waters on iron. That "pitting" of boilers is not universal where alkaline waters are used is due to the fact that corrosion is less energetic in the dark, and that the boiler plates soon become covered with a more or less protective coating.

L. ARCHBUTT, in an *addendum* (*ibid.*, 241—242) to the above paper, considers that the chief corrosive agent may be carbon dioxide, the action of which ceases when sufficient alkali is present. To prove the contrary, it is necessary to show that distilled water, free from every trace of carbon dioxide, is more corrosive to iron when slightly alkaline than when no alkali has been added. W. P. S.

**Properties, Analysis, and Classification of Ternary Steels.** LÉON GUILLET (*Compt. rend.*, 1905, **141**, 107—108. Compare Abstr., 1903, ii, 297, 483, 650, 730 ; 1904, ii, 128, 266, 619, 664, 739).—The author's micrographical investigations of special steels have shown that these ternary steels may be grouped in the following classes: (1) perlitic; (2) martensitic, including troostitic; (3)  $\gamma$ -iron; (4) carbide; and (5) graphitic steels.

Important conclusions as to the constitution of the steels, and as to such of their properties as are of interest from an industrial point of view, have been drawn from the microstructure, the inferences being uncertain only in the case of the perlitic group. G. Y.

**Transformations of Hydrated Ferric Sulphate.** ALBERT RECOURA (*Compt. rend.*, 1905, **141**, 108—110. Compare this vol., ii, 527).—When exposed to the air for some days, a concentrated solution of ferric sulphate deposits a spongy, nodular, saffron-yellow mass consisting of the basic sulphate,  $6\text{Fe}_2(\text{SO}_4)_3 \cdot \text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ , impregnated with an acid sulphate of variable constitution which can be removed by extraction with absolute alcohol. Of a specimen of the yellow mass having the composition  $\text{Fe}_2(\text{SO}_4)_3 \cdot 11\text{H}_2\text{O}$ , 89 per cent. of the iron remained in the form of the basic sulphate after treatment with alcohol. If the yellow mass is allowed to dry in air until it has reached the composition  $\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$ , the basic and acid sulphates recombine, and can no longer be separated by alcohol. The solidification of ferric sulphate on evaporation of its solutions takes place therefore in two stages. In consequence of this the yellow mass is not homogeneous, but contains in some parts an excess of the basic, in others of the acid salt. If this is made into a paste with a little water and spread on a plate, at the end of 24 hours the ferric sulphate,  $\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$ , is obtained as a white, homogeneous layer.

The white and yellow hydrated ferric sulphates must differ in constitution. The yellow sulphate dissolves immediately in water, but the white modification does so only slowly. Whilst both sulphates are soluble in absolute alcohol without decomposition, the yellow modification is decomposed to the insoluble basic sulphate



and the soluble acid sulphate,  $\text{Fe}_2\text{O}_3 \cdot 4\text{SO}_3$ , on treatment with alcohol (96 per cent.), or with a little water, or on exposure to moist air, under which conditions the white modification is stable.

The yellow and white hydrated sulphates, as well as the anhydrous sulphate, yield identical solutions when dissolved in water.

G. Y.

**Alkaline Cobaltous Solutions.** CARL TUBANDT (*Zeit. anorg. Chem.*, 1905, 45, 368—373).—Metallic cobalt is not attacked either when hot or when cold by potassium or sodium hydroxide; if it is exposed, however, as anode to an electric current, it dissolves in the alkaline liquid. The most favourable conditions for this solution are low current density (0.2 ampere per sq. dm.), high temperature, and great concentration of the alkali hydroxide solution. By inserting a copper voltameter into the circuit and comparing the separated copper with the dissolved cobalt, it is shown that the cobalt dissolves as cobaltous salt.

The cobaltous solution is blue, and in absence of air is stable for months. When electrolysed between insoluble electrodes, it precipitates part of the cobalt at the cathode as spongy metal, part at the anode as oxide; the chief part is oxidised by the oxygen given off at the anode, and the oxidation product remains suspended in the form of brown flocks in the electrolyte. An experiment in which the blue liquid is placed in a U-tube, covered with a layer of alkali hydroxide, and electrolysed with a current of 0.1 ampere shows that the cobaltous oxide migrates towards the cathode.

The cobaltous oxide is thrown down completely by shaking with barium sulphate, but is not appreciably affected by the addition of electrolytes. It does not dialyse, and is believed by the author to be present in the colloidal form.

As regards dialysis, electrolysis, and behaviour with barium sulphate, the blue alkaline cobaltous solutions containing glycerol and the green cobaltic solutions formed from them by oxidation with air or hydrogen peroxide behave similarly to these alkaline cobaltous solutions, and they also are believed to be of a colloidal character. D. H. J.

**Passivity of Nickel.** MARIO G. LEVI (*Gazzetta*, 1905, 35, i, 391—405. Compare Hittorf, *Abstr.*, 1900, ii, 705; Le Blanc and Schick, *Abstr.*, 1904, ii, 229; Le Blanc and Bindschedler, *Abstr.*, 1902, ii, 442; Just, *Abstr.*, 1903, ii, 629).—The author has measured the loss in weight of a nickel anode and the voltage at the electrodes in 1.5 per cent. solutions of a number of salts at the ordinary temperature, and with an anodic current density of 0.5 ampere per sq. dm. The results show that ordinary nickel dissolves quantitatively according to Faraday's law in solutions containing halogen salts, potassium cyanide, or sulphuric acid, whilst in sodium chlorate or nitrate, barium or cupric nitrate, sodium, ammonium, magnesium, or nickel sulphate, sodium carbonate, potassium hydroxide, or ammonium oxalate, it remains practically undissolved. In sodium acetate solution, about 50 per cent. of the theoretical quantity of nickel dissolves; the greater or less activity of the nickel in this solution depends on the treatment

to which the electrode has been subjected before electrolysis and on the physical condition of its surface.

Experiments with nickel electrodes which have undergone various preliminary treatments show that this metal tends to become passive when left for some time to itself. This phenomenon has been previously noticed in the case of chromium.

For the salt solutions examined, the activity or inactivity of the nickel depends only on the nature of the anion, and not on that of the cation, with the sole exception of the hydrogen ion.

As with other metals, rise of temperature favours the passage of nickel from the passive to the active state, and only in potassium hydroxide solution is nickel completely passive at 80°. In solutions of sodium acetate or ammonium sulphate, it retains at 80° the partial activity it shows at the ordinary temperature.

By increasing the current density, nickel is rendered more passive, but change of concentration of the electrolyte is without influence in this respect.

If the passivity of a metal depends on the formation of an insoluble coating, it should be removed by the addition of the solution of another salt, the anion of which forms with the metal a readily soluble salt. The behaviour of nickel in such mixtures of electrolytes indicates that the passivity of the metal in sodium carbonate or potassium hydroxide solution may be due to the formation of a protective layer. This could, however, not be observed in the other solutions examined, so that here the passivity appears to be due to the smallness of the reaction velocity. A small addition of sodium chloride to a solution causing passivity brings the velocity of ion-formation up to the value required for the quantitative solution of the metal. Sulphuric acid also acts in this way, but to a less extent than sodium chloride. Addition of sugar or acetone is without influence, but carbamide destroys the passivity, although it is uncertain whether its action is a direct one or whether it is due to its decomposition products. T. H. P.

**A Chromium Sulphate in which the Acid is in Two States of Combination.** ALBERT COLSON (*Compt. rend.*, 1905, 141, 119—122. Compare this vol., ii, 94, 460).—The green chromium sulphate solution, formed by shaking chromium hydroxide with a limited quantity of cold dilute sulphuric acid, has the composition  $\text{Cr}_4(\text{SO}_4)_5(\text{OH})_2$ ; when evaporated in a vacuum it yields an amorphous substance which dissolves in alcohol (90 per cent.) to a solution containing chromium and sulphuric acid in unchanged proportion. Of the five  $\text{SO}_4$  groups present, only three are immediately precipitated by barium chloride; the addition of 1 mol. or 3 mols. of barium chloride to 1 mol. of the sulphate causes immediate precipitation of barium sulphate, with a heat development of 5 and 15.2 Cal. respectively; the addition of 4 mols. of barium chloride to 1 mol. of the sulphate  $\text{Cr}_4(\text{SO}_4)_5(\text{OH})_2$  causes a heat development of only 15.5 Cal.; the solution clears only slowly and contains the elements of barium sulphate at the end of fifteen days or after some minutes' boiling.

The difference in the states of combination of the  $\text{SO}_4$  groups can be only slight, as the heat of formation of the sulphate  $\text{Cr}_4(\text{SO}_4)_5(\text{OH})_2$

is 12—16 Cal. for each mol. of sulphuric acid entering into the reaction, as the salt is completely hydrolysed by potassium hydroxide, and as the resistance to precipitation with barium chloride is not constant, diminishing with rise of temperature, increase of concentration, or addition of an excess of barium chloride.

The constitution  $\text{SO}_4(\text{Cr} \begin{smallmatrix} \text{SO}_4 \\ \text{O} \end{smallmatrix} \text{Cr} \cdot \text{SO}_4\text{H})_2$  is suggested for the penta-sulphate; in agreement with this, measurements of the depression of the freezing points of the solutions show that on total precipitation with barium chloride, 1 mol. of the sulphate  $\text{Cr}_4(\text{SO}_4)_5(\text{OH})_2$  yields 4 mols. of chloride. G. Y.

**The Preparation of Metallic Vanadium and some Vanadium Compounds.** IWAN KOPPEL and A. KAUFMANN (*Zeit. anorg. Chem.*, 1905, 45, 352—358).—Vanadium prepared by the action of aluminium (Goldschmidt's process) is not pure (from 78.2—81.1 per cent. of vanadium), but serves admirably for the preparation of a mixture of vanadium tetrachloride and oxytrichloride by treatment with chlorine. The two chlorides are easily separated by fractional distillation.

Vanadium oxytrichloride,  $\text{VOCl}_3$ , is soluble in ether or glacial acetic acid, but insoluble in chloroform. It may be prepared in solution by shaking vanadium pentoxide with glacial acetic acid into which hydrogen chloride has been passed. Ether or alcohol may take the place of the acetic acid, but the temperature must be kept down in this case to prevent the formation of  $\text{VOCl}_2$  by reduction. On adding pyridine hydrochloride to the alcoholic solution of vanadium oxytrichloride, brown, shimmering, hygroscopic needles of the compound  $\text{VOCl}_3 \cdot \text{C}_5\text{NH}_6\text{Cl} \cdot \text{C}_2\text{H}_6\text{O}$  are obtained.

**Vanadium Thiotrichloride.**—When chlorine is passed first in the cold, then at a higher temperature, over vanadium sesquisulphide, a reddish-brown liquid of the composition  $4\text{VSCl}_3 \cdot \text{S}_2\text{Cl}_2$  passes over. The liquid solidifies in a freezing-mixture to a mass of shimmering crystals which decompose in the air with separation of sulphur chloride. From a solution in ether, large, brown tablets of the composition  $4\text{VSCl}_3 \cdot \text{S}_2\text{Cl}_2 \cdot \text{C}_4\text{H}_{10}\text{O}$

gradually separate. All attempts to obtain the simple thiotrichloride,  $\text{VSCl}_3$ , have so far failed. D. H. J.

**Compounds of Quadrivalent Vanadium. III.** IWAN KOPPEL, RESZŐ GOLDMANN, and A. KAUFMANN (*Zeit. anorg. Chem.*, 1905, 45, 345—351).—From vanadyl chloride, two series of double salts are obtained with pyridine or quinoline hydrochloride, namely:

(a) Green salts:  $\text{VOCl}_2 \cdot 4(\text{R} \cdot \text{HCl}) \cdot x\text{H}_2\text{O}$ .

(b) Blue salts:  $\text{VOCl}_2 \cdot 2(\text{R} \cdot \text{HCl}) \cdot x\text{H}_2\text{O}$ .

The green compounds are formed in presence of excess of pyridine or quinoline hydrochloride with solvents which show very little ionisation (absolute alcohol, glacial acetic acid, or mixtures of alcohol and ether). As soon as the power of dissociation of the alcohol is slightly increased by addition of water, the blue compounds are formed. The differences in the dissociation of vanadyl chloride in different solvents are marked by differences in the colour of the solutions.

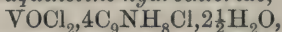


Solutions of vanadyl chloride (or of vanadium tetrachloride) in absolute alcohol or glacial acetic acid are brown; by the addition of a little water they become green, and finally blue like the aqueous solutions.

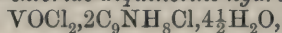
*Vanadyl chloride-tetrapyridine hydrochloride*,  $\text{VOCl}_2 \cdot 4\text{C}_5\text{NH}_6\text{Cl} \cdot 2\text{H}_2\text{O}$ , forms green, hygroscopic needles. It cannot be recrystallised unchanged, as small quantities of water or alcohol change it into the blue compound.

*Vanadyl chloride-dipyridine hydrochloride*,  $\text{VOCl}_2 \cdot 2\text{C}_5\text{NH}_6\text{Cl} \cdot 3\text{H}_2\text{O}$ .—The blue vanadyl chloride solution necessary for preparing this compound is obtained by evaporating a solution of vanadium pentoxide in hydrochloric acid and dissolving the residue in absolute alcohol or by heating vanadium pentoxide with alcoholic hydrogen chloride and some water in presence of sulphur dioxide or hydroxylamine hydrochloride as reducing agent. On adding pyridine hydrochloride to the blue alcoholic solution and evaporating over sulphuric acid or precipitating with ether, blue hygroscopic needles are obtained. It is more stable than the green compound.

*Vanadyl chloride-tetraquinoline hydrochloride*,



forms green, silky needles, and is more stable and less hygroscopic than the corresponding pyridine salt. From its alcoholic solution, the blue chloride (*vanadyl chloride-diquinoline hydrochloride*),



crystallises.

*Vanadyl ammonium carbonate*,  $7\text{VO}_2 \cdot 5\text{CO}_2 \cdot 3(\text{NH}_4)_2\text{O} \cdot 16\text{H}_2\text{O}$ , is obtained by dissolving ammonium metavanadate in the minimum quantity of sulphuric acid and reducing with sulphur dioxide, neutralising with ammonia, and, after evaporating to a small bulk, dropping slowly into a cold saturated solution of ammonium carbonate until the precipitate formed redissolves only slowly. The liquid is then filtered and concentrated over sulphuric acid. It forms violet crystals somewhat sparingly soluble in water, soluble in alkalis to a brown solution, and in acids to a blue solution; even in closed vessels it decomposes slowly with evolution of ammonia. D. H. J.

**Hydrolysis of Stannic Chloride and Stannic Bromide.** PAUL PFEIFFER (*Ber.*, 1905, 38, 2466—2470. Compare Werner and Pfeiffer, *Abstr.*, 1898, i, 464).—If a 50 per cent. solution of stannic chloride, freshly prepared by dissolving the salt in water externally cooled by ice, is shaken with ether and the ethereal solution dried and evaporated, 29 per cent. of the salt is obtained as the *hydroxytrichloride*,  $\text{SnCl}_3 \cdot \text{OH} \cdot \text{H}_2\text{O} \cdot \text{Et}_2\text{O}$ . Only traces of this are obtained from stannic chloride solutions which have been prepared some hours before extraction. On solution in ether and precipitation with light petroleum, it forms colourless, deliquescent crystals melting and decomposing at  $160^\circ$ , and decomposing when dissolved in water. The *hydroxytribromide*,  $\text{SnBr}_3 \cdot \text{OH} \cdot \text{H}_2\text{O} \cdot \text{Et}_2\text{O}$ , obtained in the same manner from stannic bromide, forms compact, transparent, colourless, deliquescent crystals melting and decomposing at about  $110^\circ$ . These hydroxyhaloids are the first

intermediate products in the hydrolysis of stannic haloids to stannic acid.

The action of absolute alcohol on stannic bromide leads to the formation of the ethoxytribromide,  $\text{SnBr}_3 \cdot \text{OEt}, \text{EtOH}$ , previously described; it crystallises in glistening, colourless leaflets and melts and decomposes at about  $160^\circ$ .

G. Y.

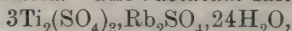
**Titanium.** II. ARTHUR STÄHLER and, in part, HEINZ WIRTHWEIN (*Ber.*, 1905, 38, 2619—2629. Compare this vol., ii, 40).—For the preparation of pure titanium compounds, the author makes use of rutile ( $\text{TiO}_2$ ), titanium iron ore ( $\text{FeTiO}_3$ ), and yttriotitanite, the finely-powdered mineral being mixed with charcoal and fused in an electric furnace to form the carbide, which is then treated with chlorine at an incipient red heat. The crude titanium chloride is then freed from chlorine by distillation and from vanadium by shaking with a little sodium amalgam for forty-eight hours, after which it becomes quite colourless. After further distillation in a vacuum, it boils at  $136^\circ$  (uncorr.). When rutile is heated with sulphur monochloride, the iron and vanadium are first given off as chlorides, almost pure titanium oxide remaining. The latter then becomes converted slowly into titanium chloride, which cannot, however, be separated from the excess of sulphur monochloride owing to the slight difference between the boiling points of the two compounds.

It is generally stated that solutions of quadrivalent titanium give a yellow colour with ether in presence of alcohol. The author finds, however, that this is only the case when the ether contains hydrogen peroxide; the presence of alcohol is unnecessary.

Dilute aqueous solutions of titanium sesquichloride have a pale wine-red colour, which is changed to dark violet or blue by the addition of an acid; this behaviour can be made use of to control the purity of the titanium sesquichloride. If a quadrivalent titanium compound is present, it is decomposed on boiling into colloidal titanous acid and free acid, which then produces the above blue coloration. The green titanium sesquichloride,  $\text{TiCl}_3 \cdot 6\text{H}_2\text{O}$ , cannot be obtained by Glatzel's method (*Abstr.*, 1877, i, 688), which yields a hydrate of titanium dichloride. If, however, a concentrated aqueous solution of the violet hydrate of the sesquichloride is covered with a layer of absolute ether and then saturated with hydrogen chloride and kept cool meanwhile, the green, unstable hydrate separates out in crystals; when the hydrogen chloride is washed out with ether, the violet compound is again formed. Green vanadium sesquichloride does not change in colour when treated with ethereal hydrogen chloride.

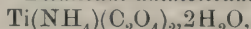
Solution of titanium in sulphuric acid and evaporation of the liquid does not yield the violet sulphate,  $\text{Ti}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ , as was stated by Glatzel (*loc. cit.*), but titanous sulphate (compare Wohler and St. Claire Deville, *Annalen*, 1857, 103, 230). By repeatedly evaporating a concentrated solution of titanium sesquichloride with dilute sulphuric acid in a vacuum, a crystalline precipitate is obtained which, after shaking with acetic acid and washing with ether, is found to be *titanium sesquisulphate sulphuric acid*,  $3\text{Ti}_2(\text{SO}_4)_3 \cdot \text{H}_2\text{SO}_4 \cdot 25\text{H}_2\text{O}$ . This acid may be quantitatively separated by heating titanium tetrachloride gently with sulphuric acid until fuming ceases, dissolving the resulting syrupy

titanium sulphate in 50 per cent. sulphuric acid, and electrolytically reducing the solution for five to six hours. The acid is obtained as a violet, finely crystalline, silky powder, which slowly dissolves in water giving a violet solution. When heated, water is first evolved, then sulphuric acid, the residue becoming green in colour; at a low red heat, sulphur dioxide is evolved and titanium dioxide remains. The ammonium salt,  $3\text{Ti}_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 18\text{H}_2\text{O}$ , forms stable, pale blue, microscopic crystals and is insoluble in water or sulphuric acid, but soluble in hydrochloric acid. The rubidium salt,



was also isolated. *Titanium sesquisulphate*,  $\text{Ti}_2(\text{SO}_4)_3$ , deposited after protracted evaporation of the violet solution of titanium sesquisulphate sulphuric acid with dilute sulphuric acid in absence of air, is a green, crystalline powder insoluble in water, alcohol, ether, or concentrated sulphuric acid, but soluble in dilute sulphuric or hydrochloric acid giving a violet solution.

Tervalent titanium forms a series of oxalates which differ from those of chromium and vanadium in being sparingly soluble in water. The *sesquioxalate*,  $\text{Ti}_2(\text{C}_2\text{O}_4)_3 \cdot 10\text{H}_2\text{O}$ , forms yellow, oblique-ended prisms and is soluble in water. *Titanium ammonium oxalate*,



*titanium potassium oxalate*,  $\text{TiK}(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O}$ , and *titanium rubidium oxalate*,  $\text{TiRb}(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O}$ , were also prepared.

On repeating the experiments of Rosenheim and Schütte (Abstr., 1901, ii, 244) on the action of dry ammonia on titanium chloride suspended in absolute ether, the author obtained a yellow powder which has approximately the composition  $\text{TiCl}_4 \cdot 8\text{NH}_3$ , but gives up ammonia very readily. The action of ammonia on gaseous titanium tetrachloride yields the compound  $\text{TiCl}_4 \cdot 6\text{NH}_3$  (compare Rosenheim and Schütte, *loc. cit.*), which remains unaltered over freshly ignited calcium chloride in absence of air, but changes to titanous acid, ammonium chloride, and ammonia over ordinary calcium chloride or in presence of air. When titanium tetrachloride is shaken for twelve hours with liquid ammonia, the compound  $\text{TiCl}_4 \cdot 8\text{NH}_3$  is obtained as a pale yellow powder. When either  $\text{TiCl}_4 \cdot 6\text{NH}_3$  or  $\text{TiCl}_4 \cdot 8\text{NH}_3$  is extracted with liquid ammonia, it gives up ammonium chloride and yields dark yellow titanamide,  $\text{Ti}(\text{NH}_2)_4$ .

T. H. P.

**The Reduction of Zirconium Oxide and the Spontaneous Formation of Zirconium Nitride.** EDGAR WEDEKIND (*Zeit. anorg. Chem.*, 1905, 45, 385—395).—It was not found possible to obtain zirconium by the action of aluminium on the oxide; the reaction is difficult and incomplete. When the oxide is heated with magnesium in a loosely covered crucible, the product is chiefly zirconium nitride,  $\text{Zr}_2\text{N}_3$ , together with a substance which forms a blue colloidal solution with water. After purification, the zirconium nitride forms a brownish-green, crystalline powder which, even on slight heating in the air, oxidises with incandescence, but is very stable towards both acids (except hydrofluoric acid) and alkalis. It is easily attacked at a low red heat by chlorine, and zirconium chloride is readily prepared in this way, although the yield is not good. It is acted on still more readily by



bromine, and zirconium tetrabromide may very advantageously be prepared by this method. In the form of a compressed powder, the nitride does not conduct an electric current. D. H. J.

**Zirconium Halogen Compounds.** ARTHUR STÄHLER and BRUNO DENK (*Ber.*, 1905, 38, 2611—2618. Compare Abstr., 1904, ii, 345; Matthews, Abstr., 1899, 295, 296).—When dry ammonia gas is passed over anhydrous zirconium chloride at the ordinary temperature, the compound  $\text{ZrCl}_4 \cdot 8\text{NH}_3$  is obtained as a loose, white powder, extremely hygroscopic and readily decomposed by water. At higher temperatures ( $232^\circ$ ), a compound  $\text{ZrCl}_4 \cdot 3\text{NH}_3$  appears to be formed. The bromide yields a compound  $\text{ZrBr}_4 \cdot 10\text{NH}_3$ . The iodide yields with gaseous ammonia the following compounds: at  $22^\circ$ ,  $\text{ZrI}_4 \cdot 8\text{NH}_3$ ; at  $100^\circ$ ,  $\text{ZrI}_4 \cdot 7\text{NH}_3$ , and at  $150^\circ$ ,  $\text{ZrI}_4 \cdot 6\text{NH}_3$ . With liquid ammonia, the compound with  $8\text{NH}_3$  is obtained, but when this is washed with liquid ammonia, a considerable amount of ammonium iodide is removed and the percentage of zirconium in the residue increases; it would thus appear that the additive compound is probably a mixture of zirconamide and ammonium iodide,  $\text{ZrI}_4 \cdot 8\text{NH}_3 = \text{Zr}(\text{NH}_2)_4 + 4\text{NH}_4\text{I}$  (compare Joannis, Abstr., 1903, ii, 140; Blix and Wirbelauer, *ibid.*, 1904, ii, 120). The iodide also forms an additive compound with ethylamine,  $\text{ZrI}_4 \cdot 6\text{NH}_2\text{Et}(\text{?})$ , and with ether a compound  $\text{ZrI}_4 \cdot 4\text{Et}_2\text{O}$ . J. J. S.

**Reduction of Thorium Oxide by Amorphous Boron and Preparation of Two Thorium Borides.** BINET DU JASSONNEIX (*Compt. rend.*, 1905, 141, 191—193).—If a mixture of thorium oxide and boron is heated for three minutes in a carbon boat in an electric furnace, with a current of 500 amperes and an *E.M.F.* of 100 volts, the mixture becomes metallic in appearance; fusion takes place only after some minutes with a current of 700 amperes. The bronze-yellow to red product is hard, contains masses of needles, and is only slightly carbonised in the parts next to the boat. With dilute hydrochloric acid, it evolves a mixture of hydrogen, which burns with a green flame, and small quantities of hydrocarbons, leaving a residue consisting of thorium tetraboride or a mixture of this with the hexaboride. Even if the amount of boron in the mixture is exactly sufficient for the reduction, the product contains about 10 per cent. of boron, and on solution in nitric acid it leaves a large residue of the unreduced oxide. If the proportion of boron is increased, the fusion becomes more difficult, but owing to volatilisation the amount of boron in the product does not exceed about 17 per cent.

*Thorium tetraboride*,  $\text{ThB}_4$ , obtained from the product containing not more than 10—12 per cent. of boron, is a yellow, metallic powder, consisting of fragments of prismatic crystals and having a sp. gr. 7.5 at  $15^\circ$ . It is dissolved by cold concentrated hydrochloric acid, by cold nitric acid with formation of boric acid, or by hot sulphuric acid. Below a red heat, it is attacked by hydrogen chloride, by chlorine, or by sulphur with formation of boron and thorium sulphides, and it burns when slightly heated in contact with fluorine.

The bronze-yellow to red product, containing over 12 per cent. of boron, contains a mixture of the borides from which the tetraboride is removed by extraction with concentrated hydrochloric acid. *Thorium*

*hexaboride*,  $\text{ThB}_6$ , is an amorphous, reddish-violet, metallic substance which has a sp. gr. 6.4 at  $15^\circ$ , is not dissolved by concentrated hydrochloric, hydrofluoric, or sulphuric acids, or by aqueous alkali hydroxides, but dissolves easily in hot nitric acid and burns when slightly heated in fluorine. It is attacked by chlorine and oxygen below a red heat, by hydrogen chloride at a red heat, and forms boron and thorium sulphides when heated in sulphur vapour. G. Y.

**Occurrence of Palladium and Platinum in Brazil.** EUGEN HUSSAK (*Chem. Centr.*, 1905, ii, 107; from *Oesterr. Zeit. Berg.-Hütt.*, 53, 278—279).—The natural occurrence of pure palladium has not been definitely proved. It is generally found as palladium-gold in Seifen and in the Jacutinga of the Itabirite, where the material is rich in gold and occurs without pyrites in the schistose quartz hematite layers. The composition of the palladium-gold alloy is very variable, the richest being found in Itabiro do Malto dentro. Pure platinum is often associated with the alloy. The occurrence of palladium-gold at Candonga in a contact limestone renders it probable that the Jacutinga has been formed from limestone by metamorphosis.

For the last 100 years, the most important sources of platinum in Brazil have been the river sands on the eastern slope of the Serra da Espinhaco (Corrego das Lagens, Fazenda Condado) and the diamond sands of the Rio Abaete in the State of Minas. Platinum is very seldom found with palladium-gold in the Jacutinga (Gongo Socco), but it more frequently occurs in the gold-quartz ores of the crystalline schists (Pernambuco). At Corrego das Lagens, platinum occurs in clusters of thin-sided, fibrous, and scaly masses which resemble deposits from solutions. Since the specific gravity is 20.2—20.48, this deposit probably contains iridium. The platinum at Condado may be derived in a similar manner from pyrites containing platinum or from sperrylite; its specific gravity is 15—16, and it probably, therefore, contains palladium. In the diamond sands of the Rio Abaete, the magnetic platinum must be derived from a neighbouring mineral which contains olivine. E. W. W.

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## Mineralogical Chemistry.

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**Gravimetric and Spectroscopic Analysis of Zinc Blendes from Sardinia.** CARLO RIMATORI (*Atti R. Accad. Lincei*, 1905, [v], 14, i, 688—696).—Results are given of analyses of fifteen samples of zinc blende found in Sardinia. Cadmium is found in all of them, whilst copper is often present. Eight of them contain more than 10 per cent. of iron, and hence consist of the variety marmatite; one of these contains 5.81 per cent. of manganese, which is a larger proportion than has been hitherto found in zinc blende. Two of them contain

small quantities of bismuth, which has previously been met with only in the blendes of Joachimsthal. Two of the samples contain indium and gallium at the same time, but more frequently indium only is found.

T. H. P.

**Copper-pitch-ore from Amzalar, Roumania.** TH. NICOLAU (*Ann. Sci. Univ. Jassy*, 1905, 3, 103—105).—The mineral described occurs with chalcopyrite, azurite, malachite, chrysocolla, and veins of quartz in a dyke of quartz-porphry traversing phyllite at Amzalar near Balancea in Dobruja. It is dark brown and has the appearance of pitch. Under the microscope, thin splinters are brown and transparent; the material is optically isotropic and apparently homogeneous, there being nothing suggestive of a mixture. The sp. gr. is 3.124, and does not vary in different fragments. After deducting 11.7 per cent. of intimately intermixed chalcopyrite, the composition is given as follows:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	Cu.	H <sub>2</sub> O.	Total.
16.37	0.93	47.64	7.39	0.82	12.46	14.39	100.00

This composition cannot be explained as a mixture of chrysocolla and limonite. Copper-pitch-ore, therefore, appears to be a homogeneous mineral (a result also recently arrived at by Lindgren and Hillebrand, this vol., ii, 97).

L. J. S.

**Titanite from Urotva, Transylvania.** TH. NICOLAU (*Ann. Sci. Univ. Jassy*, 1905, 3, 169—170).—The following analyses are of dark brown crystals of titanite from the syenite of Urotva (Jolotca), in the eastern part of Transylvania. Calcium is in part replaced by manganese, and iron is absent. The crystals are of two habits, the larger ones (7.5 mm. across) being envelope-shaped and the smaller coffin-shaped.

TiO <sub>2</sub> .	SiO <sub>2</sub> .	CaO.	MnO.	Al <sub>2</sub> O <sub>3</sub> .	Na <sub>2</sub> O.	Total.
42.24	31.10	24.30	2.09	0.64	0.06	100.43
42.65	31.03	24.19	2.34	0.55	trace	100.76

L. J. S.

## Physiological Chemistry.

**Blood Changes following Anti-typhoid Inoculation.** W. B. LEISHMAN, W. S. HARRISON, A. B. SMALLMAN, and F. M. G. TULLOCH (*J. Hygiene*, 1905, 5, 380—427).—The origin and early development of the protective substances and the immediate effect of inoculation and re-inoculation are given with full details. No "negative phase" could be detected. The methods used did not reveal the presence of a typhoid opsonin. Metschnikoff's term *stimulin* is provisionally



adopted, but the identity of stimulins is not regarded as established; they are thermostable and not to be confused with opsonins. The amount of agglutinins developed affords a good general indication of the development of other protective substances. W. D. H.

**Blood-ferments.** ADOLF JOLLES and MORITZ OPPENHEIM (*Chem. Centr.*, 1905, i, 1659; from *Virchow's Arch.*, 1905, 180, 185—225. Compare this vol., ii, 265).—Experiments have been conducted in order to determine the influence of various factors on the decomposition of hydrogen peroxide by blood. It is stated that the relative amounts of the catalase present in specimens of blood can be determined by estimating the amount of peroxide decomposed in a given time at a given concentration. The simplest method of estimation is to determine by the thiosulphate or permanganate method the amount of peroxide left undecomposed.

Normal human blood usually decomposes 23 grams of peroxide per 1 c.c. of blood, and the decomposition is retarded both by increase and decrease of temperature and also by the usual enzyme poisons. The amount decomposed appears to be independent of the condition of the hæmoglobin, and the formation of oxyhæmoglobin is independent of the enzyme. The blood of amphibious animals often shows a very low decomposing value, and the blood of fishes gives the lowest of all.

J. J. S.

**Origin of Lactose. Removal of the Mammary Glands during Lactation.** CH. PORCHER (*Compt. rend.*, 1905, 141, 73—75. Compare Abstr., 1904, ii, 424).—Soon after the operation, especially about the fourth and fifth hours, the urine contained much glucose (30—45 grams per litre). After 48 hours, however (sometimes after 12—15 hours), the urine lost its reducing power.

Under normal conditions, the blood transports glucose to the mammary glands, where, in the regular course of lactation, it is converted into disaccharide and is excreted in the milk. The removal of the glands results in an accumulation of glucose in the blood, from which it passes to the urine. The rapid cessation of the transportation of glucose to the urine is attributed to a diminution of the activity of the liver.

The glucose found in the urine is not accompanied by galactose.

N. H. J. M.

**Physiological Significance of the Urate Cells in Melliferous Insects.** L. SEMICHON (*Compt. rend.*, 1905, 140, 1715—1717).—The urate cells appear early in *Anthophora personata*, *Osmia cornuta*, *Megachile argentata*, *Dasypoda plumipes*, and *Halictus quadricinctus*, as in the case of carnivorous *Hymenoptera*. They seem to be inactive during the whole period of relaxed life. Their formation and increase occur chiefly during the active larval life.

N. H. J. M.

**Affinity of Colouring Matters for Conjunctive Tissue.** CURTIS and PAUL LEMOULT (*Compt. rend.*, 1905, 140, 1606—1608).—In order to develop the selective attraction of conjunctive tissue for certain dyes in preparations stained with picric acid, it is necessary to use dyes

having at least three sulpho-groups symmetrically distributed in the molecule. Satisfactory results are obtained with acid magenta, red-violets 4RS and 5RS, and with diamine-blue 2B and naphthol-black B.  
N. H. J. M.

**Oxyhæmoglobin of Guinea-pigs. Action of Fluorides.** M. PIETTRE and A. VILA (*Compt. rend.*, 1905, 140, 1707—1708. Compare this vol., i, 622).—Oxyhæmoglobin is only spectroscopically sensitive to fluorides in solution. Crystals produced in media containing fluorine do not possess the spectrum characteristic of fluorine.

The sensitiveness of the reaction is so great that it is obtained, in dilute acetic acid solution, with very sparingly soluble fluorides. The reaction was observed in water which had been employed for levigating powdered fluorine minerals, such as cryolite and topaz.

N. H. J. M.

**Toxicology of Mercury Diphenyl.** ÉMILE LOUISE and F. MOUTIER (*Compt. rend.*, 1905, 140, 1703—1704).—Experiments with dogs showed that mercury diphenyl is less toxic than organo-metallic compounds with fatty groups. The mercury becomes rapidly distributed when injected hypodermically, and continues to be eliminated long after injections have ceased. The toxicity of the mercury is partly masked, whilst its therapeutic properties are maintained.

N. H. J. M.

**Pilocarpine and other Reagents in Relation to Precipitin Immunity.** ORLANDO INCHLEY (*J. Hygiene*, 1905, 5, 285—303).—The elaboration of specific anti-substances is not appreciably affected by the drugs examined (pilocarpine, sodium cinnamate, nuclein, blood sera, &c.). If a temporary increase is the result, this can be explained in other ways. For instance, in the case of pilocarpine, the concentration of the blood due to general glandular activity will account for the apparent increase in the precipitin reaction.

W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Lactose Fermenting Bacteria in Fæces.** A. MACCONKEY (*J. Hygiene*, 1905, 5, 333—379).—A large number of lactose fermenting bacilli were found in the fæces both of men and animals. Some of these decompose dulcitol, some do not. Some decompose sucrose, others do not. As the *Bacillus coli communis* is more closely associated with fæces than the other groups, further research on the same lines will probably help to place the value of this organism as an index of pollution on a sound basis.

W. D. H.

**Nitrogen Bacteria.** F. LÖHNIS (*Centr. Bakt. Par.*, 1905, ii, 14, 582—604 and 713—723).—The various nitrogen-assimilating bacteria (*Bacterium pneumoniæ*, *B. lactis viscosum*, *B. radiobacter*,

*B. radicola*, *B. prodigiosum*, and *B. turcosum*) also assimilate nitrates, but in different degrees. *B. agreste* does not fix nitrogen, but assimilates nitrates vigorously, whilst *B. fluorescens* causes nitrates to disappear, chiefly by denitrification. It is probable that nitrogen in the form of ammonium salts and asparagine, &c., is more readily assimilated than nitrates.

It was found that the soil sample utilised for the above experiments rapidly converted carbamide into ammonium carbonate, owing probably to the presence of *Urobacillus Pasteurii*. Attempts to isolate this microbe were, however, unsuccessful.

N. H. J. M.

**Life Conditions of Nitrogen-collecting Bacteria.** HUGO FISCHER (*J. Landw.*, 1905, 53, 289—297. Compare this vol., ii, 189).—The conclusion is drawn that the bacterial flora depends chiefly on the nature of the soil, and that the flora can only be influenced by alterations in the character of the soil.

N. H. J. M.

**Autofermentation of Beer Yeast.** JEAN EFFRONT (*Bull. Soc. Chim.*, 1905, [iii], 33, 847—850).—Yeast has been kept in aqueous and also in an aqueous-alcoholic solution containing hydrofluoric acid; in the former case, carbon dioxide, alcohol, and sugar are formed during the first 24 hours, but with the mixture these products are not formed. Considerable differences are also met with in the amounts of nitrogenous substances left in the cells after remaining for ten days in contact with the two liquids. With pure water, the percentage of nitrogenous matter increases, but that of the carbohydrate decreases, and with the aqueous-alcoholic liquid the reverse is true. On the other hand, after ten days' maceration with water, the cells can no longer be distinguished, but after 30 months in the alcoholic liquid the cells keep their shape, the cell-wall becomes transparent, and granulations are visible in the interior.

Formaldehyde and amyl alcohol have been found among the products of autofermentation. The amounts are 38 milligrams of formaldehyde per 500 grams of yeast and 2 grams of amyl alcohol per kilogram of yeast.

J. J. S.

**Photodynamic and Optical Behaviour of Anthraquinones.** HERMANN VON TAPPEINER (*Chem. Centr.*, 1905, ii, 60—61; from *Arch. klin. Med.*, 82, 217—222).—[With A. JODLBAUER.]—The sulphonic acids of anthracene derivatives are very strongly fluorescent, and have been found also to have a very marked photodynamic action on *Paramæcia*, enzymes, and toxins. Experiments have now been made with derivatives of the anthraquinone series which do not show any visible fluorescence. In the experiments on *Paramæcia*, solutions of potassium anthraquinone-*a*-sulphonate, sodium anthraquinone-2:7-disulphonate, and sodium chrysophanate containing respectively 1 part in 500—20,000, 1 in 200—30,000, and 1 in 100,000—10,000,000, were used, whilst in the experiments on invertin, in addition to the salts of the above sulphonic acids, 0.05, 0.005, 0.01, and 0.1 per cent. solutions of sodium dichloro-anthracenedisulphonate were also employed. Both anthraquinone-disulphonic acids were found to have a distinct photodynamic action,



and resembled the corresponding anthracene acids in this respect. The action of chrysophanic acid was still more marked, and was similar to that of dichloroanthracenedisulphonic acid.

The anthraquinonesulphonic acids had no effect on invertin in glass flasks, but a more concentrated solution of sodium anthraquinone-disulphonate, when exposed in uncovered dishes by an open window, was found to destroy entirely the activity of invertin.

[With HANS LEHMANN.]—Since it has been shown by measurements that members of the anthraquinone series do possess a distinct although a very faint fluorescence, the rule connecting fluorescence with photodynamic action still appears to hold. E. W. W.

**Participation of Oxygen in the Action of Fluorescent Substances.** A. JODLBAUER and HERMANN VON TAPPEINER (*Chem. Centr.*, 1905, ii, 61—62; from *Arch. klin. Med.*, 82, 520—546. Compare Sacharow and Sachs, *Münch. med. Woch.*, 52, 297, and Pfeiffer, *Wien. klin. Woch.*, 18, 221 and 328).—Experiments on the action of sodium tetrabromotetraiodofluorescein (Rose-bengale), phenosafranine, and methylene-blue on *Proteus vulgaris*, and of erythrosine on enzymes and toxins (invertin, diastase, ricin), have shown that the effect of these fluorescent substances when exposed to light is dependent on the presence of oxygen. The compounds are inactive in the dark or in an atmosphere of hydrogen. The quantity of oxygen required is very small, and oxygen under pressure appears to have the same influence on photodynamic action. The fluorescent compounds, which had previously been found to have no action on invertin, were again tested in an atmosphere of oxygen. Quinine and harmaline almost entirely destroyed the activity of invertin in four days, whilst fluorescein had only about half the effect in the same time, and phenyl-2-methylquinoline had still less influence. Tolylene-red, Nile-blue, fluorenedisulphonic acid, and æsculin had no appreciable action in diffused daylight in four days or in sunlight in two days.

The photodynamic action on diastase in presence of oxygen did not cause the formation of more than an extremely small quantity of carbon dioxide, which was not detected with certainty, even when large quantities of the ferment were employed. The results of experiments in which so-called ozone reagents or readily oxidisable substances were used showed that oxidation did not take place, or was only very slight, even under the most favourable conditions. The change can only, therefore, be of a very limited extent, and must be due to a selective action on certain labile groups on which the specific action depends.

The decomposition of potassium iodide in diffused daylight is dependent on the presence of fluorescent compounds. Phenosafranine, azocarmine, and 4-phenyl-2-methylquinoline, and to a less extent  $\alpha$ -naphtholtrisulphonic acid,  $\beta$ -naphthylaminedisulphonic acid, and naphthionic acid, which have a strong action on cells and enzymes, do not attack potassium iodide, or only very slightly, whilst on the other hand, in the case of fluorenedisulphonic acid or æsculin the reverse is true. The potassium iodide test is liable to error, and should only be used in conjunction with quantitative experiments on *Paramæcia* or enzymes. Straub's results (*Abstr.*, 1904, i, 896) are ascribed to the

decomposition of the fluorescent substance in consequence of a bleaching action.

Eder's reaction between mercuric chloride and ammonium oxalate, which results in the formation of mercurous chloride, ammonium chloride, and carbon dioxide, is retarded by the presence of oxygen, but accelerated by the presence of fluorescent substances. The compounds of the fluorescein series, 4-phenyl-2-methylquinoline, quinine, acridine, anthraquinonedisulphonic acid, and dichloroanthracenedisulphonic acid, have been found to behave in this way, but methylene-blue, which is precipitated by Eder's solution, proved an exception. Non-fluorescent substances did not show this action. The inhibitive effect of oxygen is proportional to its partial pressure, and the action of light or of a fluorescent substance is greater in a vacuum or in an atmosphere which does not contain oxygen.

No explanation of these phenomena on the peroxide theory is feasible, but the formation of ions caused by the absorption of energy in the form of light is probably the cause of the action of fluorescent substances.

E. W. W.

**Action of Liquid Air on the Life of Seeds.** PAUL BECQUEREL (*Compt. rend.*, 1905, 140, 1652—1654).—The power of resistance of seeds towards low temperatures depends only on the amounts of water and gas present in their tissues. When a certain quantity of gas and water is present, the cold disorganises the protoplasm and the nucleus. If, however, the protoplasm has reached its maximum of concentration by drying, it completely escapes the action of low temperatures and does not freeze. The seed then retains its germinating power (compare Pictet and de Candolle, *Arch. Sci. phys. nat.*, 1895; Brown and Escombe, *Proc. Roy. Soc.*, 1895, 72, 161; and Dyer, *Abstr.*, 1900, ii, 300).

N. H. J. M.

**Transformations of Nitrogenous Substances in Seeds during Maturation.** GUSTAVE ANDRÉ (*Compt. rend.*, 1905, 140, 1417—1419. Compare *Abstr.*, 1904, ii, 634).—Vegetable albumin was not found in white lupin seeds at the commencement of their formation; when mature, the amount of nitrogen in this form was 2.5 per cent. of the total. Nitrogen in the form of legumin, also absent at the commencement, amounted to about 10 per cent. of the total at the same period. The nitrogen as soluble amides increased during maturation, and amounted at four different periods to 72, 81, 56, and 40 per cent. of the total nitrogen.

The transformations of nitrogen compounds during maturation of the seed are the reverse of those which take place during germination.

N. H. J. M.

**Compound which yields Hydrogen Cyanide in Sambucus Nigra.** GUIGNARD (*Compt. rend.*, 1905, 141, 16—20).—The greatest amount of hydrogen cyanide is obtained from the leaves, and there is no accumulation in the reserve organs. In this respect, *Sambucus* resembles *Lotus arabicus* and *Sorghum vulgare*. In the case of *Phaseolus lunatus*, the seed contains much glucoside.

N. H. J. M.

**Presence of a Cyanogenetic Glucoside in the Leaves of *Sambucus Nigra*.** ÉMILE BOURQUELOT and ÉMILE DANJON (*Compt. rend.*, 1905, 141, 59—61).—Leaves of *Sambucus nigra* contain a glucoside which, under the influence of emulsin, yields dextrose, hydrogen cyanide, and an aldehyde. The yield of hydrogen cyanide amounts to 0.126 gram from 1 kilogram of fresh leaves. N. H. J. M.

**Simultaneous Variations of Organic Acids in some Oleaginous Plants.** GUSTAVE ANDRÉ (*Compt. rend.*, 1905, 140, 1708—1711).—The amounts of soluble and insoluble oxalates in *Mesembryanthemum crystallinum* diminish as the age of the plant increases, whilst the malic acid increases. The sum of the oxalic and malic acids remains about the same (one-sixth of the dry matter). The ash of *M. crystallinum* contains a high percentage of potassium.

*Sedum azureum*, which contains more calcium than potassium, possesses very little total oxalate, and the soluble oxalates disappear completely before the plant dies. Malic acid is present at the commencement in considerable quantity and its amount does not change much during growth. N. H. J. M.

**Carbohydrate Reserves of Evergreen Trees.** LECLERC DU SABLON (*Compt. rend.*, 1905, 140, 1608—1610).—The maximum of reserve substances, which occurs in the autumn in the case of caducous leaves, is reached at the beginning of spring with evergreen plants. The minimum is in July or August. This explains why in evergreen trees assimilation is relatively feeble but continuous all the year round, whilst caducous leaves assimilate from May to October with much greater vigour. N. H. J. M.

**Rhizomes of *Rheum palmatum* and *Rheum officinale* cultivated in Berne.** ALEXANDER TSCHIRCH and P. A. A. F. EIJKEN (*Chem. Centr.*, 1905, ii, 144—145; from *Schweiz. Woch. Pharm.*, 1904, Nos. 40 and 41. Compare *Abstr.*, 1903, i, 107; 1904, ii, 435).—The freshly cut surfaces of *Rheum palmatum* and *Rheum officinale* become strongly coloured on exposure to air, probably in consequence of the formation of gallic acid. Chrysophanic acid from *Rheum palmatum* melted at 162° and contained the methyl ester. By dissolving chrysophanic acid in ammonia and precipitating with acetic acid according to Hesse's method, a compound has been prepared which is either an amino-derivative or an ammonium salt; it crystallises from dilute acetic acid in dark brown, lustrous needles, melts above 260°, and is insoluble in ether but soluble in glacial acetic acid or in alcohol, forming a blood-red solution. The alcoholic solution is orange-red, but on the addition of alkalis or alkaline earths becomes red. *Amino-emodin* or *ammonia-emodin*, obtained by treating emodin with ammonia, forms a purplish-red powder which is insoluble in ether, but forms a cherry-red solution in alcohol. *isoEmodin*,  $C_{15}H_{10}O_5$ , has been isolated from the hydroxymethylanthraquinone by means of toluene; it sublimes in feathery crystals, melts at 212°, and is soluble in ether, alcohol, benzene, chloroform, glacial acetic acid, and in alkali hydroxides or



carbonates. Its solubility in hot toluene is greater than that of emodin. Ferric chloride gives a dark brown coloration with the alcoholic solution, and baryta and lime-water give flocculent, cherry-red precipitates. *iso*Emodin is probably identical with Hesse's rhabarberone. Rhein,  $C_{15}H_8O_6$ , crystallises from pyridine in bright yellow needles and melts at  $314^\circ$ ; diacetylrhein,  $C_{15}H_8Ac_2O_6$ , crystallises in bright yellow needles, and melts at  $247-248^\circ$ . *Amino-rhein* or *ammonia-rhein* is brown, and forms an orange-red solution in alcohol and a cherry-red solution in baryta water. Chrysophanic acid melting at  $172^\circ$ , *iso*emodin, and rhein have been isolated from the rhizomes of *Rheum officinale*, but not emodin. The roots contain the same compounds, but the presence of hydroxymethylanthraquinone in the stalks, leaves, and fruit can only be detected by microscopical methods. The fresh rhizomes also contain an oxydase. *Rheum palmatum* contains more emodin than *Rheum officinale*, but the proportion of emodin to chrysophanic acid is much less in the latter. E. W. W.

**Poisonous Action of Sodium Fluoride on Plants.** OSCAR LOEW (*Chem. Centr.*, 1905, i, 1717—1718; from *Allg. bot. Zeit.*, 94, 330—338).—Sodium fluoride acts injuriously in two ways; it withdraws calcium from the plant and also acts like an alkaloid.

Some bacteria show a feeble development in 1 per cent. solutions of sodium fluoride; mould fungi will grow in 0.1 per cent. solutions.

N. H. J. M.

**Action on the Soil of the Mineral Constituents of Plant Residues Soluble in Water.** S. KRAWKOW (*J. Landw.*, 1905, 53, 279—288).—In accordance with results obtained by Schroeder and by Ramann, it was found that water percolating through leaves extracted considerable portions of the potassium, magnesium, sulphuric acid, and phosphoric acid, but very little of the calcium and silica. A good deal of the iron was also extracted.

When the water which had already percolated through leaves was allowed to percolate through soil, 58 per cent. of the potassium, 69 per cent. of the phosphoric acid, and 38 per cent. of the magnesium removed from the leaves was retained by the soil. On the other hand, the amounts of calcium and sulphuric acid showed a further increase after the water had percolated through the soil owing to the substitution of bases and to the action of the organic acids previously extracted from the leaves. The soil did not absorb appreciable amounts of sodium, iron, manganese, or silica.

N. H. J. M.

**Water in the Soil and the Consumption of Water by Plants.** CONRAD VON SEELHORST and MÜTHER (*J. Landw.*, 1905, 53, 239—259).—Experiments with oats and clover grown in boxes, on the consumption of water. The results are given fully in tables.

The fallow box lost nearly 6 grams of nitrogen, as nitrates, in nine months (June to February), the drainage containing on the average 24.6 per million of nitric nitrogen. The drainage amounted to 244 litres. The boxes with vegetation gave only 43.5, 44.6, and 30 litres respectively, containing 0.55, 0.49, and 1.18 gram of nitrogen. The greatest loss (1.18 grams) was in the clover box.

N. H. J. M.

**Origin, Amount, and Importance of Carbon Dioxide in Soils.** JULIUS STOKLASA and ADOLF ERNEST (*Centr. Bakt. Par.*, 1905, ii, 14, 723—736).—The carbon dioxide in soils is produced in the respiration of bacteria, moulds, algæ, and the roots of plants. The amount produced by microbes in 1 kilo. of arable soil (to a depth of 40 cm.) in 24 hours was from 17 to 50 mg. If only 15 mg. of carbon dioxide were produced in that time, the amount per hectare per annum would be 1400 kilos. when only 200 days of the year, on which an average temperature of 15° is reached, are counted. In the case of forest soil, the amount may be four times as great.

As regards the production of carbon by roots, 2,000,000 cereal plants (the minimal number per hectare) give off 60 kilos. per diem. Of the different plants included in the experiments, *Trifolium pratense*, *Beta vulgaris*, and *Avena sativa* produced the greatest amounts.

The action of roots, especially young roots, on the mineral substance of the soil is due to the carbon dioxide of the roots and not to organic acids, which, as Czapek (*Jahrb. wissens. Bot.*, 29) and Kossowitsch have shown, are not secreted by roots.

N. H. J. M.

**Specific Action of Phosphoric Acid on Oat Plants grown in Black Moor Soil.** H. CLAUSEN (*J. Landw.*, 1905, 53, 213—223).—The soil contains 8.2 per cent. of humus and 0.05 per cent. of calcium carbonate. The subsoil is yellow sand.

Application of phosphates increases the yield of oats, but diminishes the proportion of grain. The latter effect of phosphoric acid is less when the soil is dry and when aëration is increased.

Whilst the straw of the unmanured oats is pale yellow, that of the plants manured with superphosphate is bluish-red. Analysis of the ash of the plants shows that the former contains less calcium, but more than ten times as much iron as the latter. Calcium carbonate slightly increases both grain and straw, whilst basic slag somewhat reduces the yield of grain and considerably increases the straw.

N. H. J. M.

## Analytical Chemistry.

**Improvements in Gas Analysis Apparatus.** ALFRED H. WHITE and EDWARD D. CAMPBELL (*J. Amer. Chem. Soc.*, 1905, 27, 732—736).—An improved Hempel apparatus, the chief object of which is to prevent any chance of loss or gain in the volume of gas when transferring it to the burette or pipette.

L. DE K.

**Methods of Electro-analysis.** NICOLAI A. PUSCHIN and R. M. TRECHZINSKY (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 392—417).—The authors give the results of their investigations on the most suitable forms and arrangement of the apparatus in an electro-chemical labor-

atory. The paper does not admit of concise abstraction, but some of the more important points referred to are as follows.

In order to allow of the employment of a certain voltage as well as of a certain current density, the electrodes should be perforated plates, so arranged that the distance between them can be readily altered. The electrolytic cells should be tall parallelepipedal troughs of thin glass. In electro-analytical operations, both the voltage and the resistance should be exactly adjusted previously, and arrangements are described by which this can be rapidly effected, making use of Kohlrausch's alternating current and telephone method.

Contrary to what is indicated in electro-chemical text-books, the presence of a precipitate in the electrolytic liquid does not interfere with the electrolysis.

The advantages of using a rotating cathode or anode in conjunction with a high current density can be secured by the simpler device of keeping the solution in a state of vigorous agitation.

Designs are shown of simple switchboards for use in electro-chemical laboratories.

T. H. P.

#### Handling of Precipitates for Solution and Reprecipitation.

FRANK A. GOOCH (*Amer. J. Sci.*, 1905, [iv], 20, 11—12).—In case it is advisable to purify a precipitate by redissolving and reprecipitating the same, the author proposes to place within the filter a movable lining of platinum gauze on which the precipitate rests for the most part and with which it may be removed. The simplest plan is to cut a platinum gauze of such a shape that when folded it makes a cone of an angle a little less than  $60^\circ$ , and, holding it by pincers at the point of overlapping, it is placed within the filter and allowed to fit itself closely by the natural spring of the gauze when released. After the precipitate has been collected, the gauze is lifted out and immersed in a beaker containing the suitable solvent. The small amount of precipitate still adhering to the filter is readily removed by means of the wash-bottle. The final collection of the precipitate is of course made on the plain filter.

When using the Gooch perforated crucible, some precipitates are difficult to dissolve off the asbestos felt for the purpose of purification. In such cases, a disc of platinum perforated and provided with a wire handle is recommended.

L. DE K.

**New Forms of [Analytical] Laboratory Apparatus.** CARL KIPPENBERGER (*Zeit. angew. Chem.*, 1905, 18, 1024—1025).—Improved apparatus, fully illustrated, for the determination of the saponification number, the estimation of volatile acids, alcohol, or ammonia by distillation, the testing of margarine and butter for sesamé oil, weighing flasks for milk and other liquids, and a pipette for measuring the amyl alcohol used in milk analysis.

L. DE K.

**Use of Nickel Vessels in Laboratories.** LOUIS L'HÔTE (*Ann. Chim. anal.*, 1905, 10, 253—254).—Nickel basins when electrolytically gold-plated and well polished may serve for evaporating strongly acid liquids. When nickel dishes or crucibles are heated in a muffle (such



as is used in sugar laboratories) until their weight has become constant, they may be used for milk analyses, including the estimation of the ash.

L. DE K.

**Detection of the More Common Acids.** STANLEY R. BENEDICT and JOHN F. SNELL (*J. Amer. Chem. Soc.*, 1905, 27, 736—744).—A systematic scheme for the detection of acids. The acids are separated as usual from the metals by boiling with a very strong solution of sodium carbonate, and should any copper have dissolved this is removed with hydrogen sulphide.

L. DE K.

**Use of Sodium Peroxide in the Analysis of Organic Substances. II.** HANS H. PRINGSHEIM and JAMES A. GIBSON (*Ber.*, 1905, 38, 2459—2461. Compare Pringsheim, *Abstr.*, 1904, ii, 447; Konek, *Abstr.*, 1903, ii, 572; 1904, ii, 588).—In order to avoid the filtration of large volumes of liquid, the reduction of the oxyhaloid salts formed by the action of sodium peroxide on organic substances containing halogens is now accomplished by the addition of sodium sulphite or sodium hydrogen sulphite and sulphuric acid; the contamination of the silver haloid with sulphate is avoided by adding 3 c.c. of concentrated nitric acid before the addition of silver nitrate.

G. Y.

**Estimation of Sulphur and Phosphoric Acid in Foods, Fæces, and Urine.** WILBUR L. DUBOIS (*J. Amer. Chem. Soc.*, 1905, 27, 729—732).—A modification of the method proposed by Neumann and Meinertz (this vol., ii, 59). Four grams of fresh foods, 2 grams of dried foods, or 1.5 grams of dried fæces are placed in a 100 c.c. nickel crucible, and when dealing with dry materials 2 c.c. of water are added. Five grams of anhydrous sodium carbonate are added, and then, gradually, 5 grams of sodium peroxide. The mass is dried very slowly over a low spirit flame, and then heated somewhat more strongly until it disintegrates and can be readily broken up into a powder. The charge is then covered with sodium peroxide and very gradually heated to bright redness. The phosphoric and sulphuric acids are estimated by the usual methods.

L. DE K.

**Estimation of Sulphites by Iodine.** R. HARMAN ASHLEY (*Amer. J. Sci.*, 1905, [iv], 20, 13—16. Compare this vol., ii, 351).—The author now states that it is possible to obtain good results in the titration of sulphites with iodine if the following conditions are adhered to.

One hundred c.c. of the sulphite solution containing one gram of sodium hydrogen carbonate are mixed with at least twice as much standard iodine solution as is required for complete oxidation. The liquid is then cautiously acidified with dilute hydrochloric acid (1:4), and the excess of iodine is titrated with standard sodium thiosulphate.

L. DE K.

**Estimation of Ammonia in Potable Waters.** JACQUES CAVALIER and ARTUS (*Bull. Soc. chim.*, 1905, [iii], 33, 745—747).—Trillat and Turchel's method for detecting ammonia in water (*ibid.*, 1895, 13,

309) is of no special value for quantitative estimations. With the majority of waters, the method can be used only after considerable concentration, and even then the evanescent nature of the precipitate of nitrogen iodide renders the estimation difficult. J. J. S.

**Free Acid in Superphosphate.** LUDWIG SCHUCHT (*Zeit. angew. Chem.*, 1905, 18, 1020—1023).—Five grams of the sample are placed in a Buchner rapid filter sieve and extracted about ten times with acetone, using about 75 c.c. of this solvent altogether. The liquid, which becomes turbid owing to the presence of iron or aluminium phosphate, is rendered perfectly clear by addition of 200 c.c. of water, and after adding a little sodium oxalate and sodium chloride the free acid is titrated with  $N/2$  alkali, using methyl-orange as indicator. If the sodium salts should cause a precipitate, this must first be filtered off. L. DE K.

**Analysis of Graphitic Silicon and Siloxicon.** PERCY E. SPIELMANN (*J. Soc. Chem. Ind.*, 1905, 24, 654—655).—Commercial [graphitic] silicon is best analysed by heating the powdered substance in a porcelain boat in a current of chlorine, when the silicon, iron, and aluminium volatilise as chlorides, leaving behind any silica or alumina. The temperature should be raised as high as possible towards the close of the operation. The gases are passed first over the surface of water contained in a flask and then through a U-tube loosely packed with wet cotton-wool; this absorbs the last traces of silicon chloride, and, after burning the wool, pure silica with only a trace of ferric oxide is left. The contents of the flask and the residue in the boat are then treated as usual.

**Siloxicon.**—This compound contains, according to an analysis by the author, 71.39 per cent. of  $\text{Si}_2\text{C}_2\text{O}$ , 10.81 per cent. of  $\text{SiCO}_3$ , 5.81 per cent. of  $\text{SiC}$ , 10.06 per cent. of graphite, 1.07 per cent. of iron, and 0.86 per cent. of impurities. The total silicon may be readily estimated by fusing the substance with sodium peroxide and treating the mass, as usual, for silica. The total carbon may be estimated with sufficient accuracy by introducing small quantities of a mixture of siloxicon and sodium peroxide into a nickel crucible containing molten peroxide and then estimating the carbon dioxide thus produced by decomposition with dilute sulphuric acid and collecting the carbon dioxide in an ammoniacal solution of calcium chloride to form calcium carbonate. On heating the siloxicon in a current of chlorine, a portion of the silicon is expelled and may be collected as described. On igniting the residue in a current of oxygen, a portion of the carbon is oxidised and may be weighed in the usual manner, whilst the residue in the boat now consists of pure  $\text{Si}_2\text{C}_2\text{O}$ . The difference between the sum of total silicon, carbon, iron, moisture, and other impurities and the weight of the sample taken represents the oxygen. For minute details as to the calculation of the results, the original paper should be consulted. L. DE K.

**Silicate Analysis. I.** EDUARD JORDIS (*Zeit. anorg. Chem.*, 1905, 45, 362—367).—Attention is again called to the fact that although carefully conducted full analyses of silicates may give results closely

approaching 100 per cent., this is really due to a compensation of errors. For instance, the separated silica may retain alkalis and chlorine, whilst on the other hand the filtrate contains dissolved silica, which is, however, partly precipitated by ammonia in the presence of iron or aluminium. The solubility of the silica is increased by the presence of large quantities of calcium or alkali chlorides. The author also states that silica may retain free mineral acids, particularly sulphuric acid, at a red heat; these, however, may be expelled by repeated moistening with water and subsequent heating. Other errors may be caused by the use of inferior utensils or impure reagents. These errors may be reduced to a minimum by avoiding the use of porcelain dishes and of glass vessels which are not proof against acids or alkalis. Platinum dishes should be used for the evaporation of the acid silica solution. Care should be taken to use pure hydrochloric acid and the various reagents should all be freshly made with freshly distilled water.

L. DE K.

**Expulsion of Ammonium Salts after Precipitation in their Presence.** PAUL JANNASCH (*J. pr. Chem.*, 1905, [ii], 72, 38).—Large quantities of ammonium chloride are expelled from solutions by evaporation with concentrated nitric acid containing nitrous acid.

G. Y.

**Electromotive Behaviour of Copper and Zinc in their Solutions in Potassium Cyanide.** II. FRITZ SPITZER (*Zeit. Elektrochem.*, 1905, 11, 391—407. Compare this vol., ii, 501).—The electrolytic estimation of zinc and copper in solutions containing potassium cyanide is investigated. It is found that the platinum (or platinum-iridium) anode is attacked and the dissolved platinum deposited on the cathode. If this is allowed for, correct results can be obtained. The deposition of the metals is very slow owing to the fact that it only takes place as the cyanide is destroyed by oxidation at the anode, the last traces of metal being deposited from a solution practically free from cyanide. The oxidation takes place most rapidly in a  $N/5$  alkaline solution. The presence of alkali hydroxide causes the deposition of some copper oxide at the anode. The presence of cyanide is therefore an unnecessary complication of the analysis, except in cases of separations; silver, for example, may be separated from copper electrolytically in presence of excess of potassium cyanide. Zinc is readily deposited in coherent form on a silvered platinum gauze cathode either from alkaline or faintly acid solutions (the latter containing excess of sodium acetate).

T. E.

**Solubility of Copper Sulphide in Alkali Polysulphides.** V. HASBREIDTER (*Zeit. angew. Chem.*, 1905, 18, 1023—1024).—A reply to the criticism of Rössing (*ibid.*, 465) regarding the author's statements as to the solubility of copper sulphide (this vol., ii, 285).

L. DE K.

**Detection of Traces of Manganese in Presence of Iron in Well Waters.** FR. CRONER (*Chem. Centr.*, 1905, ii, 74—75; from *Gesundh. Ing.*, 28, 197—198).—One hundred c.c. of the sample are



acidified with hydrochloric acid and filtered into a colorimeter 40 cm. high, 2 c.c. of a strong solution of tartaric acid are added, and then a slight excess of ammonia. On adding 2 c.c. of a saturated solution of potassium ferricyanide, a white turbidity is noticed either at once or after some time, according to the amount of manganese present. Traces of manganese may be identified in this manner.

L. DE K.

**Separation of Iron from Manganese and Magnesium, and of Aluminium and Chromium from Manganese, Zinc, Nickel, and Magnesium by Hydroxylamine in Ammoniacal Solution. IV.** PAUL JANNASCH and FRIEDRICH RÜHL (*J. pr. Chem.*, 1905, [ii], 72, 1—13. Compare Abstr., 1893, ii, 500; 1899, ii, 59; 1900, ii, 315; Jannasch and Mayer, this vol., ii, 557).—Iron may be quantitatively separated from manganese and magnesium by dissolving the substance to be analysed in hot dilute hydrochloric acid, adding 5—6 times its weight of hydroxylamine hydrochloride, and precipitating the iron by addition of concentrated ammonia to the hot solution. To ensure complete separation, it is necessary to dissolve the precipitate and repeat the precipitation in presence of about half as much hydroxylamine. If too much hydroxylamine is added, the precipitate is obtained in a finely-divided state and cannot be retained on the filter. On ignition, the precipitate, the composition of which has not been determined, yields a laminated residue of ferric oxide, which dissolves readily in hot concentrated hydrochloric acid.

In hydrochloric acid solution, chromates are reduced by hydroxylamine to chromium salts. Aluminium and chromium are quantitatively separated from manganese, zinc, nickel, and magnesium by a single precipitation with a slight excess of ammonia in presence of hydroxylamine; the precipitation is completed by warming on the water-bath. After evaporation of the filtrates and gentle ignition to expel ammonium and hydroxylamine salts, manganese, zinc, nickel, and magnesium may be estimated in the residue by the usual methods.

G. Y.

**Quantitative Separations in Presence of Hydroxylamine. V.** PAUL JANNASCH and WILHELM COHEN (*J. pr. Chem.*, 1905, [ii], 72, 14—26. Compare preceding abstract).—The precipitation of iron by ammonia in presence of hydroxylamine takes place normally in hydrobromic, hydriodic, sulphuric, or formic acid solutions; if much nitric acid is present, it must be neutralised, and the solution again acidified with a little hydrochloric acid. Organic acids, such as oxalic, citric, or tartaric acid, prevent complete precipitation; if the substance is dissolved in acetic acid, a small quantity of hydrochloric acid must be added before boiling with hydroxylamine, and after precipitation the solution may be again acidified with acetic acid. The precipitation of chromium and aluminium is effected similarly by the presence of different acids.

To separate aluminium or chromium from copper, the solution in water, or, if the chromium is present as chromate, in dilute hydrochloric acid, is boiled with hydroxylamine, excess of ammonia added,

and the solution warmed to complete precipitation; the precipitate must be well washed to free it from copper, which is estimated in the acidified filtrate by the ammonium thiocyanate method.

Iron is separated quantitatively from copper or zinc by boiling the solution in dilute hydrochloric acid with hydroxylamine until it appears colourless, and precipitating the iron by addition of ammonia to the boiling solution. The precipitate is washed, as far as possible, by decantation with boiling water, containing a little ammonia if zinc is present.

Before evaporating to dryness the filtrate containing zinc, the hydroxylamine must be decomposed by bromine water, as otherwise loss may occur owing to reduction of the zinc salt. G. Y.

**Quantitative Separation of Iron and Thorium from Uranium by Hydroxylamine in Ammoniacal Solution VI.** PAUL JANNASCH and JOHANNES SCHILLING (*J. pr. Chem.*, 1905, [ii], 72, 26—34. Compare preceding abstracts, and Abstr., 1899, ii, 59).—Iron and thorium are quantitatively separated from uranium by two precipitations by ammonia in presence of hydroxylamine salts. If the filtrate contains nitrates only, the uranium is estimated by evaporation to dryness and ignition; if other acids are present, the ammonium and hydroxylamine salts are expelled by gentle heating of the residue, or, after expulsion of the free ammonia by boiling, the hydroxylamine is decomposed by addition of bromine water, and the uranium precipitated with ammonia and weighed as  $U_3O_8$  after ignition over the blow-pipe, and as  $UO_2$  after ignition in a current of hydrogen.

With sodium acetate, thorium solutions yield slowly at the ordinary temperature, quickly on boiling, a granular, crystalline precipitate which is insoluble in excess of sodium acetate solution; the precipitation is not quantitative (compare Haber, Abstr., 1898, ii, 295). Thorium is precipitated partially from its solutions also by ammonium tartrate as a thick, white precipitate, and by tartaric acid as a voluminous, colloidal precipitate which is soluble in an excess of the reagent. Thorium is precipitated quantitatively from its solutions when boiled with ammonium, sodium, or potassium succinate.

G. Y.

**Supplementary Remarks on the Hydroxylamine Method.** PAUL JANNASCH (*J. pr. Chem.*, 1905, [ii], 72, 35—37. Compare preceding abstracts).—A discussion of the advantages of precipitation by ammonia in presence of hydroxylamine over other methods of quantitative separation.

The filtration of the iron precipitate takes place most easily if the precipitation is carried out at the ordinary temperature and the reaction mixture then heated on the water-bath for several hours.

G. Y.

**A New Delicate Reagent for Nickel.** LEO TSCHUGAEFF (*Ber.*, 1905, 38, 2520—2522).—An excess of ammonia or of sodium acetate is added to the solution to be tested for nickel and then a little powdered  $\alpha$ -dimethylglyoxime,  $OH \cdot N : CMe \cdot CMe : N \cdot OH$ . A scarlet precipitate is formed when the solution is boiled. The reaction is very

sensitive, definite results being obtained with solutions containing 1 part of nickel in 400,000 parts of water.

When cobalt is present, the solution is shaken with a large excess of ammonia before the dioxime is added.

The presence of 0.1 mg. of nickel in the presence of 500 mg. of cobalt can be distinctly recognised.

A convenient method for the preparation of dimethylglyoxime is described.

A. McK.

**Test for Molybdenum.** P. TRUCHOT (*Ann. Chim. anal.*, 1905, 10, 254).—As little as 0.01 mg. of molybdic acid may be recognised by heating the roasted substance with sulphuric acid in a porcelain crucible until only traces of free acid remain. When cold, the residue is breathed upon a few times, when, should molybdenum be present, a fine blue colour is developed. Should vanadium be also present, the colour will be more or less green.

L. DE K.

**Separation of Tungsten Trioxide and Silicon Dioxide by means of Hydrogen Chloride and the Analysis of Silicotungstates.** CARL FRIEDHEIM, W. H. HENDERSON, and ALFRED PINAGEL (*Zeit. anorg. Chem.*, 1905, 45, 396—409).—If hydrogen chloride is passed over a mixture of silicon dioxide, vanadium pentoxide, and tungsten trioxide at a cherry-red heat, the vanadium and tungsten pass over into the receiver (the vanadium partly in the quinquevalent, partly in the quadrivalent form; the tungsten only partially as trioxide); the silicon dioxide remains quantitatively in the platinum boat. The separation of the tungsten and vanadium is made after evaporation of the mixture with dilute sulphuric acid to which a little sulphurous acid has been added. The tungsten is weighed as trioxide; the vanadium is determined volumetrically by potassium permanganate.

In applying this hydrogen chloride method to ammonium salts, the material for analysis is freed from ammonia and water by heating, and the residue is then treated with hydrogen chloride as before. In dealing with potassium and sodium salts, special care must be taken to ensure that oxygen is absent from the hydrogen chloride, as it leads to the formation of chlorine, which attacks the crucible and causes unnecessary complication.

The original paper contains a careful comparison of the hydrogen chloride method with that of Marignac and others.

D. H. J.

**Estimation of Titanic Acid in Minerals.** P. TRUCHOT (*Chem. Centr.*, 1905, ii, 75; from *Rev. gen. Chim. pure appl.*, 8, 173—176).—A criticism of the various processes proposed from time to time. The following process is recommended. Two grams of the powdered mineral are fused with 12 grams of potassium-sodium carbonate and the mass is treated with cold water. The undissolved potassium titanate is dissolved in hydrochloric acid, neutralised with ammonia, again acidified with formic or acetic acid mixed with excess of sulphurous acid, and gently boiled for an hour. The precipitated oxide is then collected.

L. DE K.



**Estimation and Separation of Thoria from the Oxides of the Yttrium-Cerium Group.** WILLIAM B. GILES (*Chem. News*, 1905, 92, 1—3, 30—31).—The nitrates are dissolved in 100—200 times the amount of water, and the solution is saturated with hydrogen sulphide to reduce any ceric oxide to the cerous state. The liquid is then boiled to expel the gas, the volume of liquid being kept up by adding boiling water. When cold, a little freshly prepared moist lead carbonate of absolute purity is added, which, after acting for twelve hours with frequent stirring, completely precipitates the thoria and any zirconia, also any ferric oxide; uranic oxide, chromic oxide, and any alumina are but slowly and imperfectly precipitated.

Cerous oxide, lanthana, neodymia, praseodymia, yttria, samaria, and the members of the yttria group in general are not precipitated. After removing the excess of lead in the filtrate by means of hydrogen sulphide, they are separated as usual. The thorium precipitate is redissolved, freed from lead by means of hydrogen sulphide, and further treated by the usual method. If thought desirable, it may be subjected to a second treatment with lead carbonate. L. DE K.

**Separation of Platinum and Iridium.** L. QUENNESSEN (*Chem. News*, 1905, 92, 29—30).—After reviewing several processes, the author finally recommends the following process.

The alloy is dissolved in a mixture of one volume of nitric acid of sp. gr. 1.32 and two volumes of hydrochloric acid of sp. gr. 1.18, the liquid is evaporated to dryness and finally heated to 120° in an air-bath in order to expel completely the free nitric acid. The mass is then dissolved in water and the metals precipitated by means of metallic magnesium. The precipitate is dried and ignited and then heated to dull redness in a current of hydrogen. The mixture is treated with dilute sulphuric acid (1:10) to remove the excess of magnesium and then with dilute nitro-hydrochloric acid (1:3), which only dissolves the platinum; this is then recovered in the well-known manner by precipitation with ammonium chloride and ignition with addition of a little oxalic acid. If ignition is omitted before removing the magnesium with dilute sulphuric acid, the iridium is also dissolved. L. DE K.

**Estimation of the Loss by Ignition in Soil Analysis.** HEINRICH MEHRING (*J. Landw.*, 1905, 53, 229—237).—In order to restore to ignited calcium carbonate the whole of the carbon dioxide by treating with ammonium carbonate and drying at 150°, it is necessary to repeat the operation three times. In the case of soils containing carbonates it is impossible to obtain the correct weight in this manner. N. H. J. M.

**Detection of Methyl Alcohol [in Ethyl Alcohol].** HEYWARD SCUDDER (*J. Amer. Chem. Soc.*, 1905, 27, 892—906).—A criticism of the various tests from time to time proposed. The following modification of the resorcinol test (*Abstr.*, 1899, ii, 388) is recommended when the amount of methyl alcohol falls below 2 per cent., and when only small quantities of the sample are available. Twenty-five c.c. of the sample are

fractionated through a Hempel tube made of glass tube 25.5 cm. long, 1.7 c.c. in diameter, filled with glass beads about 3 mm. in diameter. Three fractionations are made, the first time taking 15, then 7.5, and finally 2 c.c. One c.c. of the last fraction is diluted, oxidised by immersing in it several times a spiral of red hot copper wire, boiled down to half its bulk, and then tested for formaldehyde by the resorcinol test. If much formaldehyde is present, more or less abundant flocks will be noticed, but if there is but little only a contact ring will be visible.

If other substances should be present in the alcohol which might interfere with the test, these must be first removed by suitable means, such as distillation with acids or alkalis, &c. L. DE K.

**A Reagent for Phenols.** JULES ALOY and F. LAPRADE (*Bull. Soc. chim.*, 1905, [iii], 33, 860—861).—The following solution serves as an extremely good reagent for phenolic substances. Dilute ammonium hydroxide is added to a solution of uranyl nitrate (10 grams) in water (60 c.c.) until a precipitate is just formed and the filtrate made up to 100 c.c. In testing for a phenol, 2 c.c. of the solution under examination are neutralised and the reagent added until no further coloration is produced. All phenols, simple or complex, with the exception of those containing numerous negative groups, for example, picric acid, give a red coloration. Mineral acids or alkalis destroy the colour.

J. J. S.

**Estimation of Glycerol in Lyes.** KARL BRAUN (*Chem. Zeit.*, 1905, 29, 763—765).—A review of the technical processes used for the determination of glycerol.

A modification of the dichromate process is proposed; 1 c.c. of the clarified lye is mixed with an excess of a strong solution of potassium dichromate, 10 c.c. of sulphuric acid are added, and the carbon dioxide generated on boiling is collected with the usual precautions in normal potassium hydroxide absolutely free from carbonate. The carbon dioxide is then precipitated with a hot solution of barium chloride, the precipitated barium carbonate is collected, washed until free from alkali, and then estimated volumetrically in the usual manner.

L. DE K.

**Estimation of the Harmful Nitrogen in the Beet and in the Products of Sugar Factories.** KARL ANDRLIK (*Zeit. Zuckerind. Böhm.*, 1905, 29, 513—518).—It has been shown by Herzfeld (*Zeit. Ver. Deut. Zuck. Ind.*, 1888, 38, 121) that a knowledge of the harmful nitrogen content is of great importance for the evaluation of the beet, and the author now gives the following simple method for estimating this nitrogen. One hundred grams of the beet pulp are weighed out and introduced into a flask holding 403 c.c., 3 c.c. being the volume of the washed and dried beet residue and precipitate. Water is added until the volume is about 340 c.c., and the flask heated for a quarter of an hour in a water-bath at 80—85°. Forty c.c. of a suspension of cupric hydroxide are then added, and 10 c.c. of aluminium sulphate solution (200 grams of the crystallised sulphate

per litre), the volume being then made up to about 408 c.c. and the flask well shaken. The flask is again heated at 80—85° for a quarter to half an hour and afterwards cooled, alcohol being added to bring the volume up to 403 c.c. In 100 c.c. of the clear filtrate, the following estimations are made: (1) total nitrogen by Kjeldahl's method, using sulphuric acid and a drop of mercury for the decolorisation; (2) ammonia- and amide-nitrogen, by boiling the 100 c.c. of liquid with 1 c.c. of concentrated sulphuric acid for two hours in a reflux apparatus, adding magnesia until the solution is alkaline to phenolphthalein, then a little paraffin, and, distilling off the ammonia in the ordinary way. The difference between the two amounts of nitrogen thus obtained, when multiplied by four, gives the percentage of harmful nitrogen.

The filtrate from the copper precipitate is used also for the estimation of the sugar, 30—50 c.c. of the liquid being stirred up with 2—4 grams of zinc dust and filtered. The polarisation value of the solution multiplied by 1.042 gives the amount of sugar in the beet.

The molasses contain 1 part of harmful nitrogen per 25 to 27 parts of sugar. Ninety per cent. of the harmful nitrogen of the beet goes into the diffusion juice, and thence, in undiminished quantity, into the molasses. So that the harmful nitrogen is the main factor determining the proportion of molasses formed.

The cupric hydroxide used above for the precipitation of the proteid matter is prepared as follows: 200 grams of crystallised copper sulphate are dissolved in 10 litres of water and precipitated with sodium hydroxide solution; after the deposit has settled, the liquid is decanted away and the cupric hydroxide washed once by decantation with water. Twenty c.c. of glycerol are then added and the volume made up to 2 litres. The liquid can be kept for two months without appreciable change.

T. H. P.

**Influence of the [Harmful] Nitrogen on the Purity of Sugar Syrup.** KARL ANDRLÍK and J. URBAN (*Zeit. Zuckerind. Böhm.*, 1905, 29, 519—522).—The analysis of a large number of sugar syrups shows that a moderately regular relation exists between the purity coefficient and the content of harmful nitrogen, an increase in the latter causing a lowering of the former. With 1 part of harmful nitrogen corresponds from 15.1 to 17.7, or, on the average, 16.1 parts of non-saccharine material. This ratio of the harmful nitrogen to the total non-sugar of the syrup—to which the term "nitrogen-coefficient" is given—is regarded by the authors as a fairly constant magnitude, which undergoes but slight alterations in one and the same factory and during the whole of any one beet season.

The coefficient of purity,  $Q$ , of the syrup can be calculated from the expression  $Q = \frac{10,000}{100 + K_N + N_N}$ , where  $K_N$  is the nitrogen-coefficient and  $N_N$  the harmful nitrogen per 100 parts of sugar. In a number of syrups examined, the greatest difference between the calculated and actual coefficients of purity was found to be less than 0.7 per cent.

Knowing the amounts of sugar and harmful nitrogen present in a sample of beet, and assuming that 97 per cent. of the sugar and 90



per cent. of the harmful nitrogen pass into the diffusion syrup, the coefficient of purity of the saturated syrup can be calculated.

T. H. P.

**Use of Fermentation Methods for the Analysis of Starch Syrup.** ED. VON RAUMER (*Zeit. Nahr. Genussm.*, 1905, 9, 705—726).—By the use of pure yeast cultures, such as *Saccharomyces Marxianus*, which ferment dextrose, but not maltose, and have little action on dextrans, the author finds that ordinary starch syrup ("glucose") contains at least 13 per cent. of maltose. Where pure yeasts cannot be regularly obtained, bottom-fermentation beer yeast may be employed for the estimation of dextrans. The dextrin obtained from starch syrup is fermented or changed by the action of pressed yeast to the extent of about one-half, and the remainder is quite altered in its properties from the original dextrin.

W. P. S.

**New Method of Milk Analysis.** J. BELLIER (*Ann. Chim. anal.*, 1905, 10, 268—276).—Briefly, the process is as follows: a known weight of the sample is absorbed in a weighed piece of sponge, which is then dried at 80° and reweighed. The increase = total solids. The sponge is then extracted with ether; the loss = fat. The casein is then rendered insoluble by fumigating the sponge with formaldehyde vapour, and the lactose *plus* the bulk of the ash is extracted with 50 per cent. alcohol containing 5 per cent. of acetic acid. After washing with water, the sponge is again dried and the lactose found from the loss in weight, the casein being weighed directly.

The amount of ash retained by the casein may be taken as 0.01 per cent.; that extracted by the acid alcohol may be judged with sufficient accuracy by multiplying the non-fatty solids by 0.076; this factor only applies to cow's milk, and presupposes the absence of borates or other mineral salts.

L. DE K.

**Estimation of Fat in [Milk, Condensed Milk, and Malted] Infant and Invalid Foods.** C. B. COCHRAN (*J. Amer. Chem. Soc.*, 1905, 27, 906—909).—The apparatus consists of a flask furnished with a long, narrow, graduated neck, and also with a side-tube through which the liquids are introduced. Five c.c. of milk or 5 c.c. of condensed milk previously diluted (1:4) are introduced into the flask and mixed with 2.5 c.c. of 80 per cent. acetic acid, and then with 2.5 c.c. of strong sulphuric acid, and the flask is placed in hot water until the contents assume a coffee colour. When cold, 4 c.c. of ether are added, the whole is well shaken and then again placed in hot water until the ether has boiled off. Hot water is now introduced until the fat rises in the neck, where its volume is read off. The neck is so graduated that each division represents 0.1 per cent. of fat.

When dealing with infant or invalid foods, 1.72 grams of the sample are mixed with 5 c.c. of water and then analysed like milk; the result is multiplied by three. If an attempt is made to estimate the fat in such foods by direct extraction with light petroleum, only a very small fraction of the fat actually present is obtained.

L. DE K.

**Use of Mineral Oil for the Determination of the Maumené Figure of Oils.** FILIPPO SUZZI (*Chem. Centr.*, 1905, ii, 80—81; from *Boll. Chim. Farm.*, 44, 301—308).—When testing oils by Maumené's process (mixing with sulphuric acid and observing the rise in temperature), some oils become overheated and must be first suitably diluted with olive oil. Bishop and others have proposed the use of mineral oil, but the author cannot recommend this for drying oils. In the case of other oils, addition of mineral oil is permissible if the following formula is applied:  $g = i/r \times v$ , in which  $g$  is the desired Maumené's figure,  $i$  the observed rise in temperature,  $r$  the volume of the mixture minus the volume of the mineral oil, and  $v$  the total volume of the mixture.

L. DE K.

**Optical Activity of the More Important Vegetable Oils.** M. A. RAKUSIN (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 442—451).—The author gives the results of measurements, by himself and others, of the sp. gr. and optical activity of 27 oils of vegetable origin.

T. H. P.

**Optical Properties of Castor Oil, Cod-liver Oil, Neatsfoot Oil, and a Few Essential Oils.** HERMANN C. LYTGOE (*J. Amer. Chem. Soc.*, 1905, 27, 887—892).—A series of tables showing the refraction in the butyrefractometer at different temperatures of these oils. The sp. gr. and polarisation in the Ventzke apparatus is also given.

L. DE K.

**Detection of Olive Oil which has been Extracted by means of Carbon Disulphide.** GEORGES HALPHEN (*J. Pharm. Chim.*, 1905, [vi], 22, 54—56).—Although every effort is made by the manufacturers to remove all traces of carbon disulphide from olive oil which has been extracted by this solvent, some sulphur compounds always remain in the oil. These may be detected by saponifying the oil, salting out the soap by the addition of sodium chloride or sulphate, and testing the aqueous solution with silver nitrate. The thiosulphate yielded by all olive oils which have contained carbon disulphide gives a brown precipitate of silver sulphide. As pure olive oils themselves contain a small quantity of reducing substance which gives a faint brown coloration with silver nitrate, it is necessary to add a little copper sulphate to the soap solution before salting out. After adding the silver nitrate solution, the whole is acidified with acetic acid, boiled, cooled, and treated with an excess of ammonia. In this way, the test is rendered more delicate.

W. P. S.

**Gasometric Estimation of Formaldehyde.** GEORGE B. FRANKFORTER and RODNEY WEST (*J. Amer. Chem. Soc.*, 1905, 27, 714—719).—On adding 1 c.c. of formaldehyde solution to a mixture of 20 c.c. of normal potassium hydroxide, 25 c.c. of water, and 10 c.c. of hydrogen peroxide, one-half of the hydrogen from the aldehyde is liberated quantitatively, and when collected with the usual precautions its volume represents the formaldehyde contained in the sample.

Instead of a mixture of potassium hydroxide and hydrogen peroxide,

a solution of 2 grams of sodium peroxide in 50 c.c. of water may be employed, but the results are then liable to exceed the real amount slightly owing to liberation of oxygen by the action of the water on the peroxide.]

L. DE K.

**Estimation of Vanillin, Coumarin, and Acetanilide in Vanilla Extract.** A. L. WINTON and E. MONROE BAILEY (*J. Amer. Chem. Soc.*, 1905, 27, 719—724. Compare Abstr., 1903, ii, 341).—A modification of the process recommended by Hess and Prescott. Twenty-five grams of the sample are diluted in a marked beaker to 50 c.c., evaporated at 70° to 25 c.c., again diluted to 50 c.c., and once more concentrated to 25 c.c. Normal lead acetate is added until no further precipitate forms, the precipitate is then collected and washed with hot water until the total filtrate amounts to 50 c.c. This, when cold, is shaken with 20 c.c. of ether, and the extraction is then repeated three times, using 15 c.c. of ether each time. The ethereal solution is shaken first with 10 c.c. of a 2 per cent. ammonia solution, and then three or four times in succession with 5 c.c. of the same. The ammoniacal extract contains the vanillin with traces of acetanilide. The ether is allowed to evaporate at the ordinary temperature, and the residue is dried in a desiccator and weighed. It is then extracted repeatedly with light petroleum (b. p. 30—40°), and the residue, after drying, is again weighed. It consists of acetanilide, and may be identified by the usual tests and its melting point. The petroleum, on evaporation, will leave any coumarin, also readily identified. The vanillin may be recovered from its ammoniacal solution by acidifying with hydrochloric acid and repeated agitation with ether. It is still liable to contain acetanilide, from which it may be freed by a second agitation with ether in the presence of ammonia. On evaporating the ether, the acetanilide remains.

L. DE K.

**Micro-chemical Analysis of Cinchona Barks.** P. VAN LEERSUM (*Chem. Centr.*, 1905, ii, 83; from *Pharm. Weekbl.*, 42, 432—435).—One milligram of the finely powdered bark is heated for a few minutes with 2 c.c. and then once more with 1 c.c. of benzene; the solution is evaporated to dryness and the residue dissolved in acetic acid. After evaporating, the residue is dissolved in water, and the solution is tested for quinine with sodium tartrate, potassium oxalate, and potassium chromate. It is as well also to apply the herepathite reaction, for which a weak solution of iodine and potassium iodide in a mixture of equal parts of water, alcohol, and acetic acid is used. When testing barks containing much of the inferior alkaloids, the quinine should be fractionally precipitated with sodium hydrogen carbonate and dissolved in ether.

L. DE K.



## General and Physical Chemistry.

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**Magnetic Double Refraction of Sodium Vapour.** J. GEEST (*Arch. Néerland.*, 1905, [ii], 10, 291—335).—The double refraction produced when a beam of light passes through sodium vapour in a strong magnetic field in a direction perpendicular to the lines of force has been examined and the phenomena registered photographically. Detailed observations relative to the quadruplet resulting from the ray  $D_1$ , and the sextet resulting from  $D_2$ , are recorded, and equations are developed on the basis of Voigt's theory which account for the complicated phenomena observed. H. M. D.

**Charge carried by the  $\alpha$ - and  $\beta$ -Rays of Radium.** ERNEST RUTHERFORD (*Phil. Mag.*, 1905, [vi], 10, 193—208. Compare Abstr., 1904, ii, 799; this vol., ii, 218, 495).—In order to determine the charge carried by the  $\alpha$ -particles, experiments were made with radium as nearly as possible in the condition of minimum activity, so as to avoid complications arising from the presence of  $\beta$ -particles. A known small quantity of radium bromide was dissolved in water and the solution evaporated uniformly on a polished aluminium or glass plate. The film of radium thus obtained was so thin ( $2.4 \times 10^{-5}$  grams per sq. cm.) that only a very small fraction of the  $\alpha$ -particles was absorbed by the radium itself. The saturation current due to the deposit thus obtained in the condition of minimum activity was measured between the radium-covered plate and a second plate placed above it at a distance of 3.5 cm., the electrodes being contained in a brass vessel in which a good vacuum was maintained by Dewar's charcoal absorption method. The apparatus was placed between the pole-pieces of a large electro-magnet so that the field was parallel to the plane of the plates, and the current was measured for various potential differences with and without the magnetic field, the radium-covered plate being in each case made positive and negative alternatively. When the magnetic field had attained a certain strength, the magnitude of the observed current was practically unaltered by further increase, indicating that the field was strong enough to prevent all the electrons from reaching the opposite plate. Assuming that each  $\alpha$ -particle carries the same charge as an ion, then, from the value of the saturation current in the magnetic field and the known quantity of radium bromide employed, it is calculated that the total number of  $\alpha$ -particles expelled per second from one gram of radium at its minimum activity is  $6.2 \times 10^{-10}$  and in radioactive equilibrium four times as many, that is,  $2.5 \times 10^{-11}$  (compare W. H. Bragg, this vol., ii, 4). In all probability the  $\alpha$ -particles are already charged at the moment of expulsion.

Slow-speed electrons were emitted with the  $\alpha$ -particles, and the current conveyed by these, as exemplified by the measurements without magnetic field, is sufficient to mask completely the current due to the  $\alpha$ -particles. The fact that the current without magnetic field

is always greater when the radium-covered plate is negative than when it is positive shows that a greater number of electrons is emitted from this plate than from the other. The observations seem to indicate that these electrons constitute a type of secondary radiation resulting from the impact of  $\alpha$ -particles on matter.

For the determination of the charge carried by the  $\beta$ -particles, a rod of lead, previously exposed to radium emanation until the excited activity had attained its maximum value, and wrapped in aluminium foil of thickness sufficient to absorb the  $\alpha$ -rays completely, was suspended as the central electrode in a metal cylinder which was evacuated. The quantity of radium bromide corresponding with the  $\gamma$ -ray activity of the rod immediately after its removal from the emanation was first measured, and then in the above-mentioned apparatus the current due to the  $\beta$ -radiation was determined after a known time interval. From the known decay curve, this current was corrected to the original condition of the rod corresponding with the determined quantity of radium bromide. From the data, it is calculated that the number of  $\beta$ -particles expelled from one gram of radium per second is  $7.3 \times 10^{10}$ . This result, which is probably a little too high, is in agreement with the theory of successive changes, according to which four  $\alpha$ -particles are expelled from radium in radioactive equilibrium for each  $\beta$ -particle.

From the calculated number of  $\alpha$ -particles expelled per gram per second, several other constants are deduced. Assuming that only one  $\alpha$ -particle is expelled during the disintegration of the radium atom, it follows that in a gram of radium about 0.5 milligram disintegrates per year. The time required for half transformation of the radium is 1280 years, and the average life of radium is 1850 years. Assuming that each atom of radium gives rise to one atom of emanation, the maximum volume of emanation obtainable from one gram of radium in equilibrium is 0.83 c.mm. (Ramsay and Soddy found experimentally about 1 c.mm.).

From the previously determined kinetic energy of the  $\alpha$ -particle =  $5.9 \times 10^{-6}$  erg, the emission of energy in gram calories per gram per hour is calculated to be 126 (Curie and Laborde found 100 by experiment).

The average number of ions produced by each  $\alpha$ -particle in air at atmospheric pressure is calculated to be 86,000, or, since the range of the particle is 3 cm., the number of ions per centimetre of path in air at normal pressure is 29,000. The ionising power of the  $\alpha$ -particles appears to be about twice as great as that of electrons.

Finally, the average energy required to produce an ion is calculated to be  $2.7 \times 10^{-11}$  ergs.

H. M. D.

**Action of Radium Emanations on Minerals and Gems.**  
CHARLES BASKERVILLE and L. B. LOCKHART (*Amer. J. Sci.*, 1905, [iv], 20, 95—96).—The emanation from 0.25 gram of radium chloride, 7000 uranies strong (one uranie being the radioactivity of metallic uranium), was allowed to act on various minerals at the temperature of liquid air. Wollastonite, willemite, greenockite, and tiffanyite were found to glow strongly. Kunzite, which is very responsive to

radium, exhibited no fluorescence or phosphorescence when the emanations were condensed; it is therefore responsive to the  $\beta$ - and  $\gamma$ -rays only. Pectolite and spodumene did not glow.

It was also observed that zinc sulphide does not glow when cooled to the temperature of liquid air, either with or without exhaustion of the air. Similarly, no effect is observed when zinc sulphide in a vacuum is suddenly subjected to atmospheric pressure, but when warmed to the ordinary temperature, after being cooled by means of liquid air, it glows brilliantly.

H. M. D.

**Radiotellurium and Polonium.** WILLY MARCKWALD (*Jahrb. Radioaktiv. Elektronik.*, 1905, 2, 133—136. Compare this vol., ii, 159).—The opinion expressed by Debierne (*Abstr.*, 1904, ii, 642) that no distinction can be drawn between radiotellurium and polonium is not supported by the experimental data. The decay curves of different specimens of polonium prepared by Mme. Curie indicate that several radioactive constituents are present. On the other hand, independent determinations of the rate of decay of radiotellurium have given the same constant, and there can be little doubt as to its individual and specific character.

H. M. D.

**Radioactivity Constant of Radiotellurium.** WILLY MARCKWALD, H. GREINACHER, and K. HERRMANN (*Jahrb. Radioaktiv. Elektronik.*, 1905, 2, 136—139).—The radioactivity at different times was obtained by measurement of the saturation current between two strips of silver, on one of which the radiotellurium had been deposited, the quantity being less than 0.001 milligram. The electrodes, about 2 mm. apart, were sealed into a glass tube, and the times required for charging a condenser of known capacity to a given potential by the saturation current were measured. The experimental data satisfy the logarithmic equation  $I_t = I_0 e^{-\lambda t}$ . The radioactive constant is 0.00497 day, or  $57.4 \times 10^{-9}$  seconds. The activity falls to half value in 139.6 days, and the average life of radiotellurium is 201.2 days.

H. M. D.

**Decay of the Radioactivity of Radiotellurium.** H. GREINACHER (*Jahrb. Radioaktiv. Elektronik.*, 1905, 2, 139—142).—Similar experiments (compare preceding abstract) were made with a specimen of radiotellurium deposited two years previously on a strip of copper. The observed rate of decay is expressible by means of the same constant as that of the freshly deposited radiotellurium. Working with a constant difference of potential, it was found that when the distance between the electrodes is gradually increased, the current at first increases, attains a maximum, and then decreases. As the decay of the radioactivity proceeds, the distance to which the electrodes must be separated to obtain the maximum current gradually increases.

H. M. D.

**Gases produced by Actinium.** ANDRÉ DEBIERNE (*Compt. rend.*, 1905, 141, 383—385. Compare *Abstr.*, 1904, ii, 223, 729).—The gas evolved by a solution of actinium chloride in water was examined by



Ramsay and Soddy's method and shown to consist of hydrogen, oxygen, and helium. The amount of helium produced is similar to that yielded by radium, although the amount of emanation furnished by actinium is very small. The disengagement of helium from solid actinium fluoride, dried at  $200^{\circ}$ , was also observed. In some cases, the gas obtained from the solid salt gave an intense continuous spectrum in which hydrogen and mercury lines showed faintly. The nature of the gas producing this spectrum has not yet been determined.

T. A. H.

**Phosphorescence of Zinc Sulphide through the Influence of Condensed Gases obtained by Heating Rare-earth Minerals.** CHARLES BASKERVILLE and L. B. LOCKHART (*Amer. J. Sci.*, 1905, [iv], 20, 93—94).—A large number of minerals containing thorium and uranium and several artificial uranium compounds were ignited, the evolved gases condensed, and their effect on phosphorescent zinc sulphide was observed. Although no very definite conclusion could be drawn from the experiments, it appeared that those minerals which afford the largest quantities of helium give the greatest amounts of emanation. The detailed observations are recorded.

H. M. D.

**Supposed Radioactivity of Hydrogen Peroxide.** MAURICE PADOA (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 43—44).—The author shows that the action of hydrogen peroxide at a distance on a photographic plate cannot be due to any form of radiation, but is caused by the emission from the peroxide of vapours capable of diffusing unchanged through various substances. If platinum black or manganese dioxide, which is capable of decomposing hydrogen peroxide, is inserted between the peroxide and the photographic plate, no action takes place.

T. H. P.

**Electrical Conductivity and Absorptive Power for Heat Radiations of Metallic Sulphides and Oxides occurring Naturally.** JOHANN KOENIGSBERGER and O. REICHENHEIM (*Centr. Min.*, 1905, 454—470. Compare Hagen and Rubens, *Abstr.*, 1903, ii, 348).—Quantitative determinations were made of the electrical conductivity and of the absorptive and reflective powers for heat radiations of the following minerals: hæmatite, marcasite, pyrites, molybdenite, stibnite, galena, chalcocite, and graphite. The results are in agreement with Maxwell's equation  $n^2\kappa = \sigma\tau$ , where  $n$  is the index of refraction,  $\kappa$  that of absorption,  $\sigma$  the absolute conductivity of the substance, and  $\tau$  the period of the electromagnetic vibration.

L. J. S.

**Liquid Dielectrics.** P. GOURÉ DE VILLEMONTÉE (*Compt. rend.*, 1905, 141, 179—181).—Two cylindrical condensers are employed filled respectively with petroleum and with paraffin oil; the outer coating is raised to a potential  $V$ , the inner being connected to earth; the inner coating is then connected with the electrometer and the outer to earth, and the change on the inner measured. It is found, if  $p$  be the charge and  $t$  the time of charging, that  $\log p/Vt$  is a linear function of  $\log t$ . In the next experiments, the inner cylinder was

connected directly with an electrometer, the outer being at potential  $V$ , and it was found that the charge, in equal time, is proportional to the potential  $V$ . A curve is also given expressing the effect of time. The liquid itself is found to acquire no charge. L. M. J.

**Limiting Conductivity of certain Binary Electrolytes in Acetone.** PAUL DUTOIT and ALEX. LEVIER (*J. Chim. Phys.*, 1905, 3, 435—454. Compare Carrara, *Abstr.*, 1897, ii, 471; Laszczynski, *Abstr.*, 1896, ii, 556).—The authors have investigated the cause of the lack of agreement in the results obtained for the conductivity of acetone solutions by previous investigators. The measurements were made with the bromides, iodides, and thiocyanates of lithium, sodium, potassium, and ammonium, carefully purified acetone having a specific conductivity  $0.5\text{--}2.0 \times 10^{-7}$  (Siemens unit) being employed as solvent.

Concordant values can only be obtained when unplatinised electrodes are used, the dissolved electrolyte being absorbed to an appreciable extent by platinum black. Errors may also result in consequence of changes of the solute and of the presence of very small quantities of impurities in the solvent. For instance, the conductivity of ammonium salts varies with the time, and in the case of lithium thiocyanate very different results are obtained with different specimens of the salt.

The following numbers, obtained by interpolation, represent the values of the molecular conductivity at  $18^\circ$  (Siemens units):—

$V$ .	250.	500.	1000.	2000.	5000.	10,000.	20,000.	50,000.	100,000.	$\infty$ .
LiBr .....	47.0	65.0	82.0	99.5	120.5	133.0	142.0	150.5	154.0	155.0
NaBr .....	73.0	88.0	104.0	120.2	136.5	145.0	150.9	157.2	158.0	158.0
KBr .....	—	—	—	129.5	139.0	147.0	152.5	155.5	—	155.5
NH <sub>4</sub> Br .....	—	49.2	61.4	77.5	100.3	118.6	135.7	153.0	157.0	157.5
LiI .....	—	113.0	125.6	135.8	145.4	150.1	154.0	157.0	157.0	157.0
NaI .....	—	121.0	130.6	139.8	148.8	152.4	155.0	155.5	155.5	155.5
KI .....	—	127.3	136.8	143.1	150.7	155.0	157.0	157.5	157.5	157.5
NH <sub>4</sub> I .....	—	95.4	110.5	126.5	142.0	150.0	155.1	157.0	157.5	157.5
NaCNS .....	91.5	107.0	122.0	137.5	151.0	—	—	—	—	(169)
KCNS .....	113.4	126.7	139.0	148.5	158.5	163.5	167.5	170.0	170.0	170.0
NH <sub>4</sub> CNS ...	66	83	102	122	144	157	166	170	171	171

In all cases the molecular conductivity increases with the dilution and approximates to a limiting value. The limiting values satisfy the law of Kohlrausch, but the ratio of the ionic velocities is different from that in water. From the limiting conductivity values the degree of dissociation of the various electrolytes has been calculated. The dissociation of the corresponding salts increases in the series: ammonium, lithium, sodium, potassium, and in the series: chloride, bromide, thiocyanate, iodide. The extent of the dissociation appears thus to depend in an additive manner on the component ions.

H. M. D.

**Effect caused by Heating the Cathode of the Silver Voltameter to Redness on the Value of the Electrochemical Equivalent.** G. VAN DIJK (*Arch. Néerland.*, 1905, [ii], 10, 277—283. Compare *Abstr.*, 1904, ii, 255).—The author's experiments indicate that no measurable quantity of solution is enclosed by the

deposited silver except when the deposition takes place on a layer of the metal deposited previously which has been heated to redness, whereby probably small fissures and cavities are produced in consequence of unequal expansion of the silver layer and the containing platinum vessel. The true value of the electrochemical equivalent of silver is given as 0.011180.

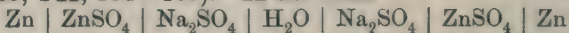
H. M. D.

**Deposition of Alloys from Mixed Solutions.** CHARLES B. JACOBS (*J. Amer. Chem. Soc.*, 1905, 27, 972—976).—The following method has been devised for the simultaneous deposition of zinc and nickel. Neutral solutions of zinc and nickel sulphates were used in the bath, and varying proportions of ammonium sulphate and chloride were added in order to regulate the internal resistance. The anodes employed were of zinc and nickel respectively. In order to maintain the proper difference in voltage between the two anodes and the cathode, two generators were used running at different voltages, that at the higher voltage for the zinc, and that at the lower voltage for the nickel anode, the current returning through the cathode by a common third lead to the generators. The anodes were arranged on each side of the revolving cathode at distances which could be varied, and it was thus possible to determine the voltage which, in relation to the internal resistance of the bath, would give the desired proportions of zinc and nickel in the deposit.

Some experiments were made on a small scale on the simultaneous deposition of copper and zinc from a solution of their sulphates, and a product resembling yellow brass was obtained. Better results were obtained with a cyanide solution, a copper anode being used on the low voltage side and a zinc anode on the high voltage side, and it was found that the colour of the brass could be easily regulated by varying the voltage on either side.

E. G.

**Effect of Membranes in Liquid Chains.** M. CHANOT (*Compt. rend.*, 1905, 141, 184—185).—In the chain



with symmetrical concentrations, one  $\text{Na}_2\text{SO}_4 \mid \text{H}_2\text{O}$  contact is made by means of a membrane of animal parchment, when an *E.M.F.* is produced, and the  $\text{Na}_2\text{SO}_4$  becomes negative. The difference of potential is affected by the relative positions of the solution and water and other causes which can be all traced to diffusion effects. If  $N/100$   $\text{H}_2\text{SO}_4$  replaces the  $\text{Na}_2\text{SO}_4$ , the difference of potential is in the reverse sense, and in all cases it varies with the nature of the membrane.

L. M. J.

**Determination of Melting Point.** ANTON LANDSIEDL (*Chem. Zeit.*, 1905, 29, 765—766).—The author describes an apparatus for the determination of melting points. The thermometer is fixed in a tube by a cork through which passes also a long capillary lying close to the stem of the thermometer, and having a constriction opposite the bulb of the latter. Through this permanent capillary the successive melting-point tubes may be slipped down until they lie close to the bulb of the thermometer. The tube containing the thermometer and capillary is immersed for a considerable portion of its length in



sulphuric acid, so that the melting points determined are to be regarded as corrected. The tube containing the sulphuric acid is protected by gauze, asbestos paper, and a glass cylinder, so that the loss of heat to the air is a minimum, and melting points up to  $310^{\circ}$  can be determined without trouble.

J. C. P.

**New Apparatus for the Determination of Melting Points.** MAURICE DE THIERRY (*Arch. Sci. phys. nat.*, 1905, [iv], 20, 59—61).—The author describes a form of apparatus in which the solid is placed between two contact poles in an electric circuit, which form contact when the solid melts. If the substance is itself a conductor, it is enclosed in a small, thin glass tube with a pointed end, and forms the upper contact pole; owing to the restriction at the end, no contact is made until the solid melts.

L. M. J.

**Melting Point of Gold and Expansion of some Gases at High Temperatures.** I. ADRIEN JACQUEROD and F. LOUIS PERROT (*Arch. Sci. phys. nat.*, 1905, [iv], 20, 28—58).—The present paper contains chiefly the account of the apparatus and method of procedure. The gold is in the form of a thin wire, which forms part of an electric circuit that is broken when the wire melts. It is heated in a platinum resistance furnace about 300 mm. long and 50 mm. in diameter, 58 turns of platinum wire, 0.7 mm. in diameter, being employed. The gas thermometer is constructed of fused silica, which possesses many advantages over platinum-iridium (Holborn and Day, *Abstr.*, 1901, ii, 84), notably an extremely low coefficient of expansion (0.00000162), which is very constant up to  $1000^{\circ}$ . To test the apparatus and thermometer, the boiling point of naphthalene was determined, the thermometer being filled with hydrogen; the value found was  $215.8^{\circ}$ , agreeing well with the previous determination,  $215.64^{\circ}$ . To determine the variation of temperature in different parts of the furnace, the apparent melting point of a gold wire placed in different parts was determined. Within the distance over which the thermometer bulb extended, the differences from the value at the middle point ( $1066.9^{\circ}$ ) only reached  $1.8^{\circ}$ ; near the end of the furnace, the difference reached  $8^{\circ}$ .

L. M. J.

**State of Matter in the Neighbourhood of the Critical Point.** GABRIEL BERTRAND and JEAN LECARME (*Compt. rend.*, 1905, 141, 320—323).—When a closed tube, freed from air and containing less than one-third of its volume of a solution of alizarin in alcohol, is heated, the solvent volatilises completely below the critical point, leaving the alizarin as a solid deposit. When a tube containing more than one-third of its volume of this solution is heated, the meniscus disappears at a temperature a little higher than the critical point of the solvent, the tube becomes filled with a fluid showing striae, and the dye gradually diffuses uniformly throughout the fluid, and this condition continues even if the temperature be raised  $20^{\circ}$  above the critical point.

A solution of potassium dichromate in water behaves similarly, but

the phenomenon is more difficult to exhibit in this case because of the fracture of the tubes as a result of the high pressure developed.

These observations afford further evidence in favour of the view taken by Ramsay (Abstr., 1881, 971; 1882, 136, 267; Jamin, *ibid.*, 1883, 898; Cailletet and Colardeau, *ibid.*, 1891, 779), that a substance exists simultaneously in the gaseous and liquid states at its critical point, and even at temperatures slightly above this (compare Andrews, Trans., 1870, 23, 74).  
T. A. H.

**State of Matter in the Neighbourhood of the Critical Point.** C. RAVEAU (*Compt. rend.*, 1905, 141, 348—349).—The author is of opinion that Bertrand and Lecarme (preceding abstract) are not justified in assuming that because the vapour of alcohol at a temperature below the critical point does not dissolve alizarin, it does not do so at or just above the critical point, since, as is well known, there is a rapid change in the properties of fluids in the immediate neighbourhood of the critical state.  
T. A. H.

**Parr's Method for Estimating the Heat of Combustion.** GEORG LUNGE and HERMANN GROSSMANN (*Zeit. angew. Chem.*, 1905, 18, 1249—1253).—Parr's method for determining the heat of combustion of coal is suitable for ordinary coals, but unsuitable for brown coals. A finely powdered mixture of 0.5 gram of coal, 0.5 gram of tartaric acid, and 10 grams of sodium peroxide of good quality is used for the estimation.  
A. McK.

**Thermochemistry of Phenylhydrazones.** PH. LANDRIEU (*Compt. rend.*, 1905, 141, 358—361).—The amounts of heat developed in the formation of phenylhydrazones in aqueous, alcoholic, or ethereal solution, as was most convenient, were determined experimentally, and, using existing data as to heats of formation of the various ketones and aldehydes and of phenylhydrazine, the heats of formation of the phenylhydrazones were calculated and compared with those deduced from the heats of combustion of the phenylhydrazones as determined in the calorimetric bomb. The results obtained for the phenylhydrazones of the following compounds by the two methods were respectively as follows: acetone, 45.9 and 44.9 Cal.; acetaldehyde, 40.0 and 39.1 Cal.; benzaldehyde, 11.6 and 10.1 Cal.; furfuraldehyde, 36.1 and 34.0 Cal.; salicylaldehyde, 43.6 and 41.7 Cal.; and anisaldehyde, 38.5 and 35.1 Cal. The reactions of benzophenone and acetophenone with phenylhydrazine do not take place quickly enough to be suitable for calorimetric measurement. The heats of formation of the phenylhydrazones of these two ketones were therefore deduced from their heats of combustion only, the results obtained being -10.1 Cal. and 19.4 Cal. respectively.

The amount of heat developed in the action of phenylhydrazine on aldehydes or ketones is, as a rule, from 12 to 16 Cal., and is slightly greater than that (10 to 13 Cal.) developed in the action of hydroxylamine on these substances (this vol., ii, 301).  
T. A. H.

**Dissociation of Carbon Dioxide.** WALTHER NERNST and H. VON WARTENBERG (*Chem. Centr.*, 1905, ii, 314; from *Nachr. k. Ges. Wiss. Göttingen*, 1905, 64—74).—The apparatus and methods used in investigating the dissociation of carbon dioxide resemble those previously employed in the case of water vapour (*Nachr. k. Ges. Wiss. Göttingen*, 1905, 35—45). The results of the experiments show that the catalytic action of the capillary tube through which the gases escape varies very greatly with different tubes. The range of temperature in which the dissociation is sufficiently great and the reaction velocity of the capillary sufficiently small is limited. The capillary tube must therefore be narrow. Since moisture also acts as a catalytic agent, the gas requires to be carefully dried. The results are arranged in a table in the original paper, and are also shown graphically by means of two curves. The initial portion of the upper curve, which corresponds with the formation of carbon dioxide, appears to represent a termolecular reaction. It is found, however, that the data are affected by a unimolecular reaction. The lower curve, which represents a bimolecular reaction, is also affected by the unimolecular reaction, especially in the neighbourhood of the equilibrium point. The equilibrium value  $x_0$ , when the combination of carbon monoxide with oxygen is regarded as unipolar, is 0.029. The value of  $x$  at  $1300^\circ$ , calculated from Hahn's data, is 0.00419 per cent.; thermodynamical calculations give 0.00400 at  $1300^\circ$ , 0.0138 at  $1400^\circ$ , and 0.032 at  $1478^\circ$ .

E. W. W.

**Apparatus for Measuring the Absolute Coefficient of Internal Friction of Gases.** SILVIO CHELLA (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 23—30).—Coulomb's method for the absolute measurement of the coefficient of internal friction of gases presents great difficulty when the influence of the rim of the oscillating disc is to be taken accurately into account. For the purpose of overcoming this disadvantage, the author has devised an apparatus in which the disc is replaced by a cylindrical bell; by varying the density of the latter, it is possible to keep the diameter constant whilst the weight and moment of inertia change. The apparatus is described and depicted, and the corresponding formula for the coefficient derived.

T. H. P.

**Nature of Osmotic Pressure.** ANGELO BATELLI and ANNIBALE STEFANINI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 3—14).—The authors bring forward a modification of Traube's theory of osmotic pressure, according to which osmotic phenomena are always determined by the difference between the surface tensions of the two liquids, but the direction of osmosis is always that tending to equalise the surface tensions on the two sides of the diaphragm. With water and alcohol, for example, if the diaphragm is impermeable to alcohol, the water alone passes through; whilst if it is permeable to both liquids, flow takes place in both directions. In the latter case, that direction of flow is favoured with which the change of surface tension is relatively the greater. Solutions having equal surface tensions, although not equimolecular, are always in osmotic equilibrium. It



is hence improbable that osmotic pressure is of a purely kinetic nature, as van't Hoff's theory supposes.

Nernst's derivation of formulæ for *E.M.F.* from osmotic pressure is no proof of the validity of the osmotic theory, since it has been shown by Helmholtz that the formulæ can be arrived at in quite another way.

T. H. P.

### Velocity of Crystallisation of Supersaturated Solutions.

CH. LEENHARDT (*Compt. rend.*, 1905, 141, 188—189).—The author has obtained in the case of the crystallisation of supersaturated solutions results similar to those obtained by Tammann for supercooled liquids. Thus, in the case of sodium acetate, which melts in its water of crystallisation at  $58^{\circ}$ , the velocity of crystallisation increases to about  $25^{\circ}$ , after which it remains constant to about  $-20^{\circ}$ , falling very rapidly below this temperature to become inappreciable at about  $-40^{\circ}$ . In the case of sodium thiosulphate, the effect of addition of the anhydrous salt was also studied, the results being stated to prove that the diminution of the velocity is proportional to the square root of the quantity of anhydrous salt.

L. M. J.

Catalytic Ester Exchanges. I. Contribution to the Theory of Saponification. ROBERT KREMANN (*Monatsh.*, 1905, 26, 783—822. Compare this vol., ii, 307; Skraup, *Abstr.*, 1894, i, 15; Skraup and Fortner, *Abstr.*, 1894, i, 404).—In alcoholic solution at  $60^{\circ}$ , ethyl mucate is completely hydrolysed in 2—3 minutes by a slight excess of 0.2*N* alcoholic sodium hydroxide. If an alcoholic solution of tetra-acetylmucic acid is treated with 10 per cent. less alcoholic sodium hydroxide than is necessary for complete hydrolysis and neutralisation of the carboxyl groups, it immediately yields sodium mucate, and 78 per cent. of the acetyl present is converted into ethyl acetate, the hydrolysis of which by the remaining alcoholic sodium hydroxide takes place only extremely slowly. With the amount of sodium hydroxide necessary for complete hydrolysis in alcoholic solution, ethyl tetra-acetylmucate yields about 65 per cent. of its acetyl as ethyl acetate. The yield of ethyl acetate from tetra-acetylmucic acid decreases rapidly with diminution of the amount of sodium hydroxide; with ethyl tetra-acetylmucate, the decrease is not so rapid. The formation of ethyl acetate must be due to instantaneous splitting off of the acetyl groups without consumption of sodium hydroxide. The reaction with ethyl tetra-acetylmucate is complicated by the formation of by-products, due probably to intermediate lactone formation, which takes place to a small extent if the hydrolysis is carried out at higher temperatures and in more dilute solutions.

A similar formation of ethyl or methyl acetate takes place when the acetates of polyhydric or of higher molecular monohydric alcohols, such as amyl acetate, are treated with sodium hydroxide in ethyl- or methyl-alcoholic solution. In alcoholic solution at  $60^{\circ}$ , with 5, 3, and 7 per cent. of the respective amounts of sodium hydroxide necessary for complete hydrolysis, glycol diacetate, triacetin, and mannitol hexaacetate yield immediately 93, 86, and 88 per cent. of the theoretical amounts of ethyl acetate. The yield of ethyl acetate is not increased

by the addition of larger amounts up to 94 per cent. of the theoretical quantity of sodium hydroxide, and the reaction will take place with as little as 1 per cent. of sodium hydroxide, but in that case the maximum yield of ethyl acetate is obtained only after some minutes. The rate of formation of ethyl acetate from triacetin, as determined in a series of experiments in alcoholic solution at 25°, and with 0.29, 0.58, 1.46, and 2.91 per cent. of the theoretical amount of sodium hydroxide, was found to vary with, but not strictly in proportion to, the percentage of sodium hydroxide present.

The formation of methyl acetate from triacetin in the presence of sodium hydroxide in methyl-alcoholic solution is more rapid than that of ethyl acetate in ethyl-alcoholic solution; further, ethyl acetate is formed more rapidly from glycol diacetate than from triacetin. Ethyl acetate and glycol are formed from glycol diacetate and ethyl alcohol, even in absence of sodium hydroxide.

The author considers that these "ester exchanges" are due to the formation of an equilibrium between the acetate dissolved and the acetate of the alcohol functioning as the solvent; this takes place extremely slowly owing to the small concentration of the ions (compare Euler, *Abstr.*, 1901, ii, 376), but is greatly accelerated by the addition of the more strongly dissociating sodium alkoxide. G. Y.

**New Form of Pyknometer.** R. V. STANFORD (*Phil. Mag.*, 1905, [vi], 10, 269—270).—The pyknometer is bottle-shaped, the neck terminating in a short vertical capillary. The second capillary is sealed into the body of the pyknometer a short distance below the neck, and for the greater part of its length is horizontal; near its extremity, however, the capillary is bent at right angles, so that the top is vertical. By means of a small plunger, which can be connected to the longer capillary by means of india-rubber tubing, the liquid meniscus can be brought to a mark on the horizontal portion of the tube. The pyknometer rests without support on a stand in the thermostat, and wire suspension is dispensed with. H. M. D.

**New Fractionating Tap.** A. VON BARTAL (*Chem. Zeit.*, 1905, 29, 786—787).—The tap has four horizontal tubes radiating from it, three of which, *B*, *C*, *D*, are at a lower level than the remaining one, *A*. The stopper has a horizontal groove cut completely round it at the level of the tube *A*; from the horizontal groove, a small vertical one is cut extending to the level of the other three tubes. By a slight turn of the stopper the tube *A* can be put successively into connection with either of the tubes *B*, *C*, or *D*, or can be completely shut off from them all. P. H.

**Tap for Use with Alkaline Liquids.** LASSAR-COHN (*Chem. Zeit.*, 1905, 29, 901—902).—The body and side-tubes of the tap are constructed of glass, whilst the stopper is made of phosphor-bronze; between the metallic stopper and the glass body is inserted a layer of rubber. P. H.

**Condensers with Ball Mouth-piece.** FRITZ HINDEN (*Chem. Zeit.*, 1905, 29, 809—810).—A conically elongated ball mouth-piece takes the place of the usual cork. It may be placed on various distilling flasks and even on suitable beakers. A number of illustrations are given. It is shown that the joint so formed is sufficiently tight for practical purposes. L. DE K.

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## Inorganic Chemistry.

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**Chemical Oxydases.** G. BAUDRAN (*Compt. rend.*, 1905, 141, 330—331. Compare this vol., ii, 407).—Chlorine, bromine, iodine, and iodine trichloride each give a red colour even in very dilute aqueous solutions with "guaiacol water" (Bertrand's reagent). They likewise destroy the toxicity of alkaloids and toxins. The alkali and alkaline earth salts of the halogen acids are also active, the latter being slightly the more powerful. These actions are inhibited by the presence of phenol. T. A. H.

**Methods employed in Preparing the Tables of Specific Gravity of Sulphuric, Nitric, and Hydrochloric Acids and Ammonia.** W. C. FERGUSON (*J. Soc. Chem. Ind.*, 1905, 24, 781—790).—The tables have been based on C.P. compounds. All specific gravity determinations were taken at 60° F. compared with water at 60° F. The thermometer employed was readable to 1/18° F., and was frequently checked against a standard thermometer; the accuracy of balance and weights was also systematically checked against standard weights. The effect due to expansion of the pyknometer was found to be so small as to be negligible. The strength of the standard sulphuric acid was determined by titration against standard solutions of sodium carbonate (prepared by heating to 572° F. and by igniting to constant weight), ammonium sulphate, 100 per cent. sulphuric acid (prepared by crystallisation), sulphuric anhydride, and sulphanilic acid; the results obtained varied between the limits 97.40 and 97.415 per cent., leaving out of account one value of 97.34. The caustic soda solution was prepared from C.P. caustic soda purified by baryta, and was titrated against the acid, using methyl-orange as indicator, the same substance being employed as indicator in titrating the nitric and hydrochloric acids as well as the ammonia. The nitric acid the constants of which were to be determined was free from nitrous and hydrochloric acids, and the hydrochloric acid contained only traces of impurities which would affect the determinations less than the errors of manipulation. The ammonia was prepared from C.P. ammonia by distilling it with lime into distilled water. The sulphuric acid used had sp. gr. 1.84; it was free from hydrochloric and nitric acids and ammonium salts. For further details of the methods employed, as well as for the tables of numerical results, reference should be made to the original paper. P. H.



**Phosphorus Subiodide and the Rôle of this Substance in the Allotropic Transformation of Phosphorus.** R. BOULOUCH (*Compt. rend.*, 1905, 141, 256—258).—When dry iodine is added to a solution of phosphorus in dry carbon disulphide in quantity less than is necessary to convert the phosphorus into the di-iodide, and the mixture is exposed to sunlight, *phosphorus subiodide*,  $P_4I$ , separates. This is an amorphous, red powder, it decomposes without melting, forming phosphorus di-iodide (which dissociates) and phosphorus vapour, and is only slowly attacked by water. Dilute nitric acid attacks the subiodide vigorously, liberating iodine, and with concentrated nitric acid it inflames. Concentrated solutions of the alkali hydroxides dissolve it, liberating hydrogen phosphide, and dilute solutions of the alkali hydroxides or carbonates convert it into "Leverrier's suboxide,"  $P_4OH$  (compare Gautier, this Journal, 1873, 352). Phosphorus subiodide dissolves in solutions of iodine forming phosphorus di-iodide or tri-iodide; this reaction serves to distinguish it from red phosphorus.

The catalytic conversion of yellow into red phosphorus by the agency of iodine is explained by assuming that phosphorus di-iodide is first formed, and this, in contact with excess of phosphorus, is converted into phosphorus subiodide, which at temperatures above  $160^\circ$  undergoes a series of decompositions resulting in the formation of phosphorus di-iodide, which immediately dissociates, and red phosphorus. This explanation of the allotropic transformation is similar to that proposed by Brodie (this Journal, 1852, 5, 289), and regarded as unacceptable by Hittorf.

T. A. H.

**Preparation of Vitreous Arsenious Oxide.** LORENZ SOUHEUR (D.R.-P. 159541).—Arsenious oxide is usually converted into the vitreous form by distillation or by fusion under pressure. It is found that the application of pressure alone is sufficient to effect the conversion, which is accelerated by heating to a temperature below the melting point. Thus a pressure of 2500 kilograms per sq. cm. converts arsenious acid at  $150^\circ$  completely into the vitreous modification.

C. H. D.

**Influence of Water Vapour on the Reduction of Carbon Dioxide by Carbon.** OCTAVE BOUDOUARD (*Compt. rend.*, 1905, 141, 252—253. Compare this vol., ii, 91).—"Dry" and "moist" carbon dioxide were passed over purified wood charcoal contained in a porcelain tube heated at temperatures varying from  $650^\circ$  to  $1000^\circ$ . At  $800^\circ$ , the reduction of carbon dioxide took place more rapidly in the moist than in the dry mixture, but the difference rapidly disappeared as the temperature was increased, and at  $1000^\circ$  the rapidity of action was the same whether the gas was dry or moist. The rate at which the current of gas was passed had little influence on the action. These observations indicate that the greater rapidity of reaction which attends the use of dry air in the blast furnace is the direct result of the difference in hygrometric state, and is not due to the dryness of the air favouring the formation of carbon monoxide.

T. A. H.

**Causticising [of Potassium Carbonate].** GUIDO BODLÄNDER and R. LUCAS (*Zeit. angew. Chem.*, 1905, 18, 1137—1141).—The action  $K_2CO_3 + Ca(OH)_2 = CaCO_3 + 2KOH$  is reversible; the action for technical purposes is more complete when carried out in dilute solution, although the necessity of the subsequent concentration involves an expenditure of heat.

The solubility of lime in solutions of sodium hydroxide of varying concentrations was estimated at 50°. The ratio  $(OH)^2/CO_3$  was determined with solutions of lime in a mixture of potassium hydroxide and potassium carbonate of varying concentrations at 18° and at 25° respectively. Determinations of the ratio  $(OH)^2/CO_3$  are also quoted where barium hydroxide and strontium hydroxide respectively were substituted for lime. A. McK.

**Preparation of Double Silicates of Potassium with other Bases.** ANDRÉ G. DUBOIN (*Compt. rend.*, 1905, 141, 254—256. Compare Abstr., 1895, ii, 351 and 1897, ii, 96).—When silica is projected into melted potassium fluoride contained in a platinum crucible, and to this molten liquid precipitated zinc oxide is added, and the mass produced on cooling is re-melted with the addition of potassium chloride, and maintained in a molten condition for 72 hours, two *potassium zinc silicates* are formed, which may be separated by washing with a heavy liquid prepared by dissolving mercuric iodide in solution of lithium or sodium iodide in water (this vol., ii, 637). One of these silicates forms small, prismatic crystals, has a sp. gr. 3·68 at 0°, and the composition represented by the formula  $K_2O, 6ZnO, 4SiO_2$ ; the other occurs in large, prismatic crystals, has a sp. gr. 2·96 at 0°, and the composition represented by the formula  $8K_2O, 9ZnO, 17SiO_2$ . Both are readily decomposed by hydrochloric acid. These silicates are not analogous in constitution with the potassium magnesium silicates similarly produced (*loc. cit.*). T. A. H.

**Crystallisation of Sodium Iodide from Alcohols.** MORRIS LOEB (*J. Amer. Chem. Soc.*, 1905, 27, 1019—1020).—Sodium iodide separates from methyl alcohol in plates or needles having the composition  $NaI, 3CH_3 \cdot OH$ , whilst from ethyl alcohol it crystallises as  $NaI, C_2H_5 \cdot OH$ . *n*-Propyl alcohol dissolves about one-third of its weight of sodium iodide, and the solution deposits crystals of the composition  $5NaI, 3C_3H_7 \cdot OH$ . Potassium iodide separates from an alcoholic solution in crystals which do not contain any of the solvent. E. G.

**Compounds of Sodium with Zinc.** C. H. MATHEWSON (*Zeit. anorg. Chem.*, 1905, 46, 94—112).—A complete fusion diagram has been constructed according to Tammann's methods. The melting-point curve consists of six branches; there are two well-marked maxima at 477° and 27·92 per cent. of sodium, and 576° and 16·23 per cent. of sodium respectively. Five distinct compounds of zinc and sodium exist, namely: (1)  $Na_4Sn$ , which at 405° undergoes transformation according to the equation  $Na_4Sn \rightleftharpoons 0\cdot091 Na_2Sn + \text{fused alloy } (3\cdot82 \text{ mols.})$

$\text{Na} + 0.91 \text{ mol. Sn}$ ). (2)  $\text{Na}_3\text{Sn}$ , with a melting point of  $477^\circ$ . (3)  $\text{Na}_4\text{Sn}_3$ ; it is the hardest and most brittle of the five compounds. At  $478^\circ$ , it melts with transformation according to the equation  $\text{Na}_4\text{Sn}_3 \rightleftharpoons 0.375 \text{ NaSn} + \text{fused alloy}$  (3.62 mols.  $\text{Na} + 2.62 \text{ mols. Sn}$ ). It occurs in two crystalline modifications,  $\alpha$  and  $\beta$ ; the transformation of the  $\beta$ - into the  $\alpha$ -crystals is attended by considerable increase of volume. (4)  $\text{NaSn}$ , with a melting point of  $576^\circ$ ; at  $483^\circ$ , it undergoes a polymorphous transformation. (5)  $\text{NaSn}_2$ ; it is the softest and toughest of the five compounds, and, like  $\text{NaSn}$ , has the appearance of tin. At  $305^\circ$ , it undergoes transformation in accordance with the equation  $\text{NaSn}_2 \rightleftharpoons 0.667 \text{ NaSn} + \text{fused alloy}$  (0.333 mol.  $\text{Na} + 1.333 \text{ mols. Sn}$ ). The easy oxidation of the alloys prevented their examination under the microscope. A freshly cut surface of  $\text{Na}_4\text{Sn}$  or  $\text{Na}_3\text{Sn}$  soon becomes covered in the air with a bronze film, but under vaseline the surface of the former resembles that of tin, whilst the latter is steel-blue.  $\text{Na}_4\text{Sn}_3$  shows a pale blue colour on a fresh surface; no film colour appears on oxidation. D. H. J.

**Silver-aluminium Alloys.** G. I. PETRENKO (*Zeit. anorg. Chem.*, 1905, 46, 49—59).—From the complete fusion diagram constructed by Tammann's method, it is clear that two distinct compounds of aluminium and silver exist, namely,  $\text{AlAg}_2$  and  $\text{AlAg}_3$ . The melting-point curve falls from the melting point of aluminium to the eutectic point at  $567^\circ$ , then rises to the melting point of silver; on the rising point of the curve are two breaks, at 7.21 and 11.15 per cent.  $\text{Al}$ ,  $771^\circ$  and  $7.72$  per cent.  $\text{Al}$  respectively, corresponding with the two compounds mentioned. Both compounds exist in two polymorphous forms.

The alloys with from 7.72 to 11.3 per cent. of aluminium take a good polish; those with from 0 to 7.72 per cent. of  $\text{Al}$  are quite stable in the air. D. H. J.

**Calcium Chloroborates.** LÉON OUVRARD (*Compt. rend.*, 1905, 141, 351—354. Compare Rousseau and Allaire. *Abstr.*, 1893, ii, 468, 518; 1894, ii, 413, 447; and Ouvrard, 1900, ii, 206, 207; 1901, ii, 158).—The following salts are prepared by fusing together boric anhydride and calcium chloride in various proportions, given in detail in the original, with or without the addition of lime.

The salt  $3\text{CaO}, \text{CaCl}_2, 5\text{B}_2\text{O}_3$  crystallises in needles or prisms showing longitudinal extinction, is scarcely soluble in water or dilute acetic acid, but readily so in dilute mineral acids. The compound  $3\text{CaO}, \text{CaCl}_2, 3\text{B}_2\text{O}_3$  forms arborescent masses of granular crystals, which are feebly active towards polarised light and are rendered opaque by water. There is simultaneously formed with this a calcium borate having the formula  $2\text{CaO}, \text{B}_2\text{O}_3$ , crystallising in lamellæ, which are very active towards polarised light and insoluble in water, but soluble in dilute acids.

Le Chatelier's calcium chloroborate,  $3\text{CaO}, \text{CaCl}_2, \text{B}_2\text{O}_3$  (*Abstr.*, 1884, 1261), and the calcium borate having the formula  $3\text{CaO}, \text{B}_2\text{O}_3$ , were also prepared. T. A. H.



**Behaviour of Typical Hydrated Bromides when Heated in an Atmosphere of Hydrogen Bromide.** J. LEHN KREIDER (*Amer. J. Sci.*, 1905, [iv], 20, 97—106).—The hydrated bromides of barium, magnesium, and aluminium were heated at different temperatures for half an hour in a current of dry air and in a current of hydrogen bromide, and the loss of water and of hydrogen bromide was determined in each case. The dehydration of barium bromide,  $\text{BaBr}_2 \cdot 2\text{H}_2\text{O}$ , at  $70$ — $160^\circ$  takes place without any appreciable loss of hydrogen bromide, whether heated in air or in a current of hydrogen bromide, and the rate of dehydration is approximately the same in the two cases. In the dehydration of magnesium bromide,  $\text{MgBr}_2 \cdot 6\text{H}_2\text{O}$ , approximately a third of the water may be removed without any considerable loss of hydrogen bromide. From this point, the loss of hydrogen bromide, when the salt is heated in air, increases with the temperature and is inhibited, as is the loss of water, by an atmosphere of hydrogen bromide. From this, the conclusion is drawn that two molecules of water bear a different relationship to the salt from the other four molecules. Hydrated aluminium bromide,  $\text{AlBr}_3 \cdot 6\text{H}_2\text{O}$ , when heated at  $100$ — $210^\circ$ , loses water and hydrogen bromide simultaneously both in air and in an atmosphere of hydrogen bromide, but the loss of water as well as of hydrogen bromide is retarded in the latter case. A differentiation of the water molecules in aluminium bromide is, however, not indicated by the experimental data. Formulæ for the hydrates in accordance with Cushman's hypothesis of inner and outer leakages of water are suggested to account for the observed phenomena.

H. M. D.

**Magnalium and other Light Alloys.** ROBERT E. BARNETT (*J. Soc. Chem. Ind.*, 1905, 24, 832—834).—Magnalium, which is the name given to an alloy of aluminium with magnesium, is manufactured in three varieties, X, Y, and Z. The alloy has a greater tendency to oxidation when hot than aluminium, but its advantages over that metal are its much greater tensile strength, and the fact that it is much better adapted to turning, &c. The following analyses were obtained from the various samples, most of the aluminium hydroxide being removed by digestion with sodium hydroxide before proceeding to the separation of the other metals. Alloy X contains copper, 1.76; magnesium, 1.60; nickel, 1.16 per cent., and antimony and iron in smaller quantities. Alloy Y, which appears to be intermediate in composition between X and Z except as regards nickel, contains copper, magnesium, tin, lead, a small amount of iron, and a doubtful trace of antimony. Alloy Z (soft sheet) contains tin, 3.15; copper, 0.21; magnesium, 1.58; lead, 0.72 per cent., and about 0.3 per cent. of iron. Zisium, sp. gr. 2.95, and ziskon, sp. gr. 3.35, are two silver-white alloys which are used in scientific instrument making. Zisium is essentially aluminium with small amounts of zinc, tin, copper, and traces of antimony and bismuth. Ziskon is a zinc-aluminium alloy, containing 25 per cent. of the former metal.

P. H.

**Alloys of Magnesium with Tin and Thallium.** GEORG GRUBE (*Zeit. anorg. Chem.*, 1905, 46, 76—93).—The alloys have been studied

by the fusion method of Tammann, and the results have been confirmed by microscopic examination.

**I. Magnesium-tin Alloys.**—The melting-point curve falls from the melting point of magnesium to a eutectic point corresponding with the temperature  $564.8^{\circ}$  and 39 per cent. of tin; it then rises to a maximum point at  $783.4^{\circ}$  and 70.95 per cent. of tin. From the maximum point, which indicates the existence of the definite compound,  $\text{SnMg}_2$ , it falls to a second eutectic point at  $209.4^{\circ}$  and 97.5 per cent. of tin, and finally rises to the melting point of tin.  $\text{SnMg}_2$  is formed with considerable development of heat on melting together its constituents in hydrogen at  $700\text{--}800^{\circ}$ ; it crystallises well, is brittle, and easily tarnishes in the air.

**II. Magnesium-thallium Alloys.**—The melting-point curve falls from the melting point of magnesium to a eutectic point corresponding with  $403.7^{\circ}$  and 72.5 per cent. of thallium. It next rises to a maximum at 76 per cent. and  $412.9^{\circ}$ . From this maximum it falls to a second eutectic point at  $392.9^{\circ}$  and 84.8 per cent. of thallium, and then to further eutectic points at  $355.4^{\circ}$  and 89.3 per cent. of thallium and at  $205.2^{\circ}$  and 97.1 per cent. of thallium, and finally rises to the melting point of thallium. From the course of the curve, with its sharp maximum and two concealed maxima, the existence of three compounds is inferred, namely,  $\text{Tl}_3\text{Mg}_8$ ,  $\text{TlMg}_3$ , and  $\text{Tl}_2\text{Mg}_3$ .  $\text{Tl}_3\text{Mg}_8$  melts at  $412.9^{\circ}$  to a homogeneous liquid.  $\text{TlMg}_2$  undergoes transformation at  $392.9^{\circ}$  in accordance with the equation  $\text{TlMg}_2 \rightleftharpoons 0.0796 \text{ Tl}_3\text{Mg}_8 + \text{fused alloy } (0.9204 \text{ Tl} + 1.9204 \text{ Mg})$ .  $\text{Tl}_2\text{Mg}_3$  has a transformation point at  $355.4^{\circ}$ :  $\text{Tl}_2\text{Mg}_3 \rightleftharpoons 0.1194 \text{ TlMg}_3 + \text{fused alloy } (1.8806 \text{ Tl} + 2.8806 \text{ Mg})$ . Thallium-magnesium alloys blacken in the air by oxidation, especially in presence of moisture. D. H. J.

**Heavy Liquids containing Alkali Mercuric Iodides.** ANDRÉ G. DUBOIN (*Compt. rend.*, 1905, 141, 385—388).—These liquids are prepared by adding mercuric iodide and the appropriate alkali iodide alternately to a small quantity of water until this is saturated. The solution of potassium mercuric iodide has a sp. gr. 3.196 at  $22.9^{\circ}$  and  $n = 1.730$  at  $26^{\circ}$ ; that of sodium mercuric iodide has sp. gr. 3.46 at  $26^{\circ}$  and  $n = 1.797$ ; that of lithium mercuric iodide a sp. gr. 3.28 at  $25.6^{\circ}$  and  $n = 1.783$ , and the preparation of ammonium mercuric iodide a sp. gr. 2.98 at  $26^{\circ}$  and  $n = 1.527$ .

These liquids are sensitive to atmospheric conditions. Those containing sodium or lithium give a precipitate of mercuric iodide with water, but are soluble in alcohol. The ammonium mercuric iodide solution deposits crystals having the composition  $2\text{NH}_4\text{I} \cdot \text{HgI}_2 \cdot \text{H}_2\text{O}$ . The solutions containing ammonium or potassium iodide give precipitates with the other two solutions. The sodium mercuric iodide solution is soluble in a variety of organic solvents. Cellulose swells and becomes transparent when placed in this liquid, and the product, after being washed with a solution of sodium iodide in water, dries to a horny mass. T. A. H.

**Different States of Oxidation of Aluminium Powder.** ÉMILE KOHN-ABREST (*Compt. rend.*, 1905, 141, 323—324. Compare Abstr., 1904, ii, 261).—When aluminium powder is heated in a current of air,

it begins to absorb oxygen at  $400^{\circ}$ ; between  $400^{\circ}$  and  $625^{\circ}$ , the rate of absorption increases steadily and remains constant between  $625^{\circ}$  and  $750^{\circ}$ . At  $800^{\circ}$ , a further absorption of oxygen commences, which increases as the temperature is raised to  $1000^{\circ}$ , and then remains constant between  $1000^{\circ}$  and  $1200^{\circ}$ .

When aluminium powder is heated during one hour at  $1000^{\circ}$  or for the same period at temperatures rising from  $500^{\circ}$  to  $1050^{\circ}$ , 59 per cent. of oxygen is absorbed, and no further absorption of oxygen occurs when the heating is continued for another two hours at  $1000^{\circ}$ . The product is a homogeneous pearl-grey powder, which decomposes hydrochloric acid with effervescence.

It is pointed out that the formation of a suboxide  $\text{AlO}$  would require the absorption of nearly 59 per cent. of oxygen. The results of other experiments, to be described later, indicate the possible existence of oxides of the formulæ  $\text{Al}_4\text{O}_3$  and  $\text{Al}_2\text{O}$  (compare Pionchon, *Abstr.*, 1893, ii, 572).

T. A. H.

**Mechanical Properties of Iron in Isolated Crystals.** FLORIS OSMOND and CH. FRÉMONT (*Compt. rend.*, 1905, 141, 361—363).—A number of nearly pure iron crystals, some of which measured several c.c. in volume, were isolated from a portion of a steel rail and subjected to tension, compression, hardness, and bending tests. Descriptions of the special methods of applying these tests and the numerical results obtained are given. The results show that the mechanical properties of isolated crystals of iron are a function of the crystallographic orientation in its relation to the direction in which the stress is applied. The material is very brittle in the directions of the planes of cleavage, but shows great plasticity in other directions.

T. A. H.

**Absorption Spectrum of Manganous Salts.** P. LAMBERT (*Compt. rend.*, 1905, 141, 357—358).—A specimen of manganous chloride, prepared from carefully purified manganese dioxide, gave an absorption spectrum having the following bands: (1) an intense broad band between  $\lambda = 513.0$  and  $\lambda = 557.5$ , (2) a broad, less intense band between  $\lambda = 420$  and  $\lambda = 442.50$ , and (3) a group of six narrow bands occupying the following positions: (a)  $\lambda = 410.25$  to  $\lambda = 412.25$ , (b)  $\lambda = 405.25$  to  $\lambda = 408$ , (c)  $\lambda = 402$  to  $\lambda = 403.25$ , (d)  $\lambda = 400$  to  $\lambda = 401$ , (e)  $\lambda = 396.25$  to  $\lambda = 397.75$ , and (f)  $\lambda = 394.5$  to  $\lambda = 395.75$ .

T. A. H.

**Influence of Nitrogen on Iron and Steel.** HJALMAR BRAUNE (*Rev. de Métallurgie*, 1905, 2, 497—502).—When iron is heated at  $800^{\circ}$  in an atmosphere of ammonia, iron nitride is produced, forming a solid solution with iron, lowering its melting point, and lessening its power of dissolving carbon. The nitride may be caused to diffuse equally through the iron by subsequent annealing. The size of the ferrite crystals diminishes as the percentage of nitrogen increases, and at 0.20 per cent. of nitrogen the cellular structure of the ferrite disappears, a system of linear markings appearing. The tensile strength of iron



increases with the proportion of nitrogen, the ductility falling rapidly. The magnetic coercive force and hysteresis are greatly increased.

Steel containing 1.15 per cent. of carbon becomes brittle with 0.040—0.045 per cent. of nitrogen. In the case of quenched steels, the nitride remains in solid solution in the martensite. C. H. D.

**Effect of Nitrogen on Steel.** HENRI LE CHATELIER (*Rev. de Métallurgie*, 1905, 2, 503—507).—Braune's discovery (preceding abstract) of the influence of nitrogen on iron and steel explains the difference in fragility often observed between steels of identical composition. Iron does not combine directly with atmospheric nitrogen, the presence of a basic slag and of reducing agents is necessary; it is therefore chiefly in the blast-furnace and in the basic converter that absorption of nitrogen takes place, probably through the formation of cyanides. Furnaces producing much potassium cyanide are known to yield an inferior quality of iron.

The linear markings observed in ferrite crystals containing nitrogen are identical with Neumann's lines, and are probably due to twinning, which takes place more readily in iron nitride during polishing than in pure ferrite. C. H. D.

**Variations of Basicity in Chromium Salts.** ALBERT COLSON (*Compt. rend.*, 1905, 141, 331—333).—To explain the inertness of chromium pentasulphate,  $\text{Cr}_4\text{O}(\text{SO}_4)_5$  (this vol., ii, 94), towards reagents, it is suggested that the light green hydrated oxide precipitated from violet chrome alum has the constitution  $\text{O}:\text{Cr}_2(\text{OH})_4$ . In conformity with this view, the oxide (1 mol.) dissolves in cold dilute acetic acid (6 mols.), yielding a violet-coloured solution in which a *tetra-acetate*,  $\text{O}:\text{Cr}_2(\text{C}_2\text{H}_3\text{O}_2)_4 \cdot 2\text{H}_2\text{O}$ , exists, which is obtained in the form of amorphous spangles. The chromic oxide is not readily displaced from this salt by potassium hydroxide, and on the addition of potassium hydroxide to aqueous solutions of the tetra-acetate, precipitation takes place only after several days at  $0^\circ$ , after some hours at  $20^\circ$ , and in a few minutes at  $60^\circ$  (compare this vol., ii, 460). It is suggested that on the addition of potassium hydroxide a soluble compound of the type  $\text{O}:\text{Cr}_2(\text{C}_2\text{H}_3\text{O}_2)_2\text{O}_2\text{K}_2$  is formed, two molecules of which then interact, yielding potassium acetate and chromic oxide, represented by the formula  $\text{O}:\text{Cr}_2 \begin{smallmatrix} \diagup \text{O}_2 \\ \diagdown \end{smallmatrix} \text{Cr}_2 \cdot \text{O}$ . This precipitate is dark green and is less basic than the light green product similarly precipitated from chrome alum, which, when shaken with a solution of an alkali sulphate, liberates the alkali so that the solution shows an alkaline reaction with phenolphthalein or reddened litmus (compare this vol., ii, 34).

T. A. H.

**Behaviour of Vanadium Compounds towards Metallic Gold and Gold Solutions.** FRANZ HUNDESHAGEN (*Chem. Zeit.*, 1905, 29, 799—800).—Vanadic acid and other vanadic compounds do not precipitate gold from either acid neutral or alkaline solutions; in hydrochloric acid solution or in presence of chlorides they exert a solvent action on gold, becoming thereby reduced to the vanadous or hypo-

vanadous condition ; if the solution is then made neutral or alkaline, the whole of the gold is at once precipitated as a greyish-violet powder which redissolves again on acidifying the solution. This reaction may be represented thus :



Selenic and telluric acids behave in the same way. These facts have some bearing on the deposition and solution of gold in nature.

The following is suggested as a ready test for vanadic acid in minerals: the powdered mineral, added to concentrated hydrochloric acid on a white porcelain basin, develops an orange-brown coloration of vanadium chloride, which is easily distinguished from the olive-brown produced by manganese dioxide. P. H.

**Gold-tin Alloys.** RUDOLF VOGEL (*Zeit. anorg. Chem.*, 1905, 46, 60—75).—A complete fusion diagram has been constructed according to Tammann's methods, and the results deduced have been confirmed by a microscopic investigation. For purposes of comparison, a figure is also given in which are included curves showing the results of the fusion experiments together with (1) the curve of electrical conductivity (Matthiessen), (2) the curve of electromotive force (Laurie), (3) the specific volume curve.

The curve of fusion falls sharply from the melting point of gold to a eutectic point at 280° and 20 per cent. of tin. It then, after rising to a well-marked maximum point at 37.63 per cent. of tin and 418°, falls to a second eutectic point at 217° and 90 per cent. of tin, and finally it rises to the melting point of tin. On the section between the maximum point and the second eutectic point are two breaks, namely, at 308° and 60 per cent. of tin and at 252° and 80 per cent. of tin.

Three definite compounds exist, namely,  $\text{AuSn}$ ,  $\text{AuSn}_2$ , and  $\text{AuSn}_4$ ; the last two are formed without change of volume, the first with slight dilatation.  $\text{AuSn}$  forms a metallic silver-grey mass which is distinguished from gold and tin by its brittleness and hardness, and by the fact that its electrical conductivity is greater than that of all gold-tin alloys except those with 95 to 100 per cent. of gold; it is as resistant as pure gold to the action of acids.  $\text{AuSn}_2$  is distinguished from the preceding by the form and size of its crystals. It undergoes transformation at 308° according to the equation  $\text{AuSn}_2 \rightleftharpoons 0.597 \text{ AuSn} + \text{fused alloy } (0.403 \text{ Au} + 1.403 \text{ Sn})$ .

$\text{AuSn}_4$  is coloured gold-brown by the action of nitric acid, while  $\text{AuSn}_2$  is unchanged. At 252°,  $\text{AuSn}_4$  undergoes transformation according to the equation  $\text{AuSn}_4 \rightleftharpoons 0.85 \text{ AuSn}_2 + \text{fused alloy } (0.15 \text{ Au} + 3.15 \text{ Sn})$ . D. H. J.

**Potassium Iridochloronitrite.** L. QUENNESSEN (*Compt. rend.*, 1905, 141, 258—259. Compare Leidie and Miolati and Gialdini, *Abstr.*, 1903, ii, 24).—When potassium iridium nitrite is treated with warm dilute hydrochloric acid, the liquid evaporated to dryness, and the residue dissolved in a saturated solution of potassium chloride, a

salt is precipitated, which, on recrystallisation from a boiling solution of potassium chloride, separates in small, yellow crystals, showing a blue tint when examined between crossed Nicols (compare Vèzes, *Abstr.*, 1893, ii, 213), and having the composition represented by the formula  $K_{12}Ir_3Cl_{16}(NO_2)_8, 4H_2O$ . The precipitation of this salt under these conditions illustrates the necessity, in using the nitrite method of separating metals of the platinum group, of completely destroying the nitro-compounds formed in cases where their presence is likely to interfere with the normal course of reactions.

T. A. H.

## Mineralogical Chemistry.

Formation of Oceanic Salt Deposits. XLIII. Calcium Content of the Constant Solutions at 25°. JACOBUS H. VAN'T HOFF and WALTER C. BLASDALE (*Sitzungsber. K. Akad. Wiss. Berlin*, 1905, 712—714).—This paper concludes the investigation in so far as calcium compounds at 25° are concerned, and the composition of all constant solutions, when saturated with the particular calcium salt with which the solutions are in equilibrium, is tabulated. For the sake of simplicity, gypsum, glauberite, and syngenite are the only salts taken into consideration, but the quantities of calcium found in the solutions cannot, however, on this account differ appreciably from the true equilibrium values.

Saturation with reference to NaCl and	Mols. per 1000 mols. $H_2O$ .					
	$Na_2Cl_2$ .	$K_2Cl_2$ .	$MgCl_2$ .	$MgSO_4$ .	$Na_2SO_4$ .	$CaSO_4$ .
$MgCl_2, 6H_2O$ .....	55.5	—	—	—	—	0.86
KCl .....	1.0	—	106.0	—	—	0.39
$KCl$ .....	44.5	19.5	—	—	—	0.94
$Na_2SO_4$ .....	51.0	—	—	—	12.5	0.05
$MgCl_2, 6H_2O$ , carnallite .....	1.0	0.5	105.0	—	—	0.38
KCl, carnallite .....	2.0	5.5	70.5	—	—	0.26
KCl, glaserite .....	44.0	20.0	—	—	4.5	0.03
$Na_2SO_4$ , glaserite .....	44.0	10.5	—	—	14.5	0.02
$Na_2SO_4$ , blödite .....	46.0	—	—	16.5	3.0	0.04
$MgSO_4, 7H_2O$ , blödite .....	26.0	—	7.0	34.0	—	0.00
$MgSO_4, 7H_2O$ , $MgSO_4, 6H_2O$ .....	4.0	—	67.5	12.0	—	0.19
$MgSO_4, 6H_2O$ , kieserite .....	2.5	—	79.0	9.5	—	0.12
Kieserite, $MgCl_2, 6H_2O$ .....	1.0	—	101.0	5.0	—	0.25
KCl, glaserite, picromerite ... ..	23.0	14.0	21.5	14.0	—	0.08
KCl, picromerite, leonite .....	19.5	14.5	25.5	14.5	—	0.09
KCl, leonite, kainite .....	9.5	9.5	47.0	14.5	—	0.13
KCl, carnallite .....	2.5	6.0	68.0	5.0	—	0.24
Carnallite, kainite, kieserite .....	1.0	1.0	85.5	8.0	—	0.13
$Na_2SO_4$ , glaserite, blödite .....	42.0	8.0	—	16.0	6.0	0.06
Glaserite, blödite, picromerite .....	27.5	10.5	16.5	18.5	—	0.08
Leonite, blödite, picromerite .....	22.0	10.5	23.0	19.0	—	0.08
Leonite, blödite, $MgSO_4, 7H_2O$ .....	10.5	7.5	42.0	19.0	—	0.1
Leonite, kainite, $MgSO_4, 7H_2O$ .....	9.0	7.5	45.0	19.5	—	0.09
$MgSO_4, 6H_2O$ , kainite, $MgSO_4, 7H_2O$ .....	3.5	4.0	66.5	13.0	—	0.2
$MgSO_4, 6H_2O$ , kainite, kieserite .....	1.5	2.0	77.0	10.0	—	0.21
Carnallite, $MgCl_2, 6H_2O$ , kieserite ...	1.0	0.5	100.0	5.0	—	0.15

H. M. D.



**Chemistry of Ore Deposition. Precipitation of Copper by Natural Silicates.** EUGENE C. SULLIVAN (*J. Amer. Chem. Soc.*, 1905, 27, 976—979).—A study has been made of the action of various natural silicates, including kaolin, shale, and feldspars, in a powdered state on solutions of copper sulphate. It is found that a double decomposition takes place, the copper being precipitated and an equivalent quantity of other bases (chiefly alkalis and alkaline earths) entering the solution. A certain amount of sulphate is precipitated with the copper, and it is at present uncertain whether this is due to adsorption of copper sulphate or to the precipitation of a basic copper salt. The quantity of copper precipitated varies with the fineness of the powdered silicate, and it appears therefore that the action takes place only on the surface of the particles. A specimen of shale in one case removed 95 per cent. and in another case the whole of the copper from a solution, the liquid being still neutral at the close of the experiment. E. G.

## Physiological Chemistry.

**Preparation and Properties of Protoplasmic Extracts of Blood Corpuscles.** AUGUSTE LUMIÈRE, LOUIS LUMIÈRE, and J. CHEVROTIER (*Compt. rend.*, 1905, 141, 142—143).—The substance is prepared by vigorously centrifugalising a mixture of blood and an isotonic liquid (1:20), collecting the globules, and washing several times with the same liquid. The whole mass is then diluted with distilled water to the original volume of the blood and subjected to alternate freezing and warming to 35° in order to break the envelopes of the cells. The mixture is again centrifugalised, the liquid decanted and rendered isotonic by adding sodium chloride. It is then filtered and kept in sterilised flasks.

The resulting liquid (hæmoplase) rapidly loses oxygen in a vacuum, acquiring a violet-black colour; the red colour is restored by agitation in air. It possesses the properties of an oxydase in a marked degree. It is very slightly toxic. N. H. J. M.

**Distribution of Saccharine Matters in the Plasma and in the Blood Corpuscles.** RAPHAEL LÉPINE and BOULUD (*Compt. rend.*, 1905, 141, 175—177).—The determination of the saccharine matters in blood is far from giving the amount contained in the plasma, and the amount of these substances in corpuscles is not by any means negligible, being about a third of that contained in the plasma. When the amount of sugar in the blood increases suddenly, the corpuscles may contain as much as the plasma; or even more in exceptional cases of acute alcoholic intoxication. N. H. J. M.

**Digestion of Proteids in the Stomach.** LUDWIG TOBLER (*Zeit. physiol. Chem.*, 1905, 45, 185—215).—The process of digestion of foods

in the dog's stomach has been examined with the aid of a duodenal fistula by a method details of which are given.

The digestion does not take place throughout the whole contents simultaneously, but solution takes place along the surface layers of the wall of the stomach, and a few minutes after a meal the expulsion of the first products of digestion begins, and these reach the intestine mainly in the form of thin liquids. With raw meat, some 50—65 per cent. enters the intestine in the dissolved form and only some 20 per cent. in the undissolved state. The dissolved proteids consist of peptones (80 per cent.) and albumoses (20—30 per cent.). In the stomach itself, considerable absorption of proteids occurs. When the pylorus reflex is retarded, the process is quicker and less complete, and then the amount of undissolved proteid increases, the absorption diminishes, and in the dissolved proteids the albumoses are in excess of the peptones.

J. J. S.

**Secretion of the Human Pancreas.** ALEXANDER ELLINGER and MAX COHN (*Zeit. physiol. Chem.*, 1905, 45, 28—37. Compare A. A. Walter, *Abstr.*, 1900, ii, 553; O. Schumm, *ibid.*, 1903, ii, 32, 439; Glaessner, *ibid.*, 1904, ii, 270).—The secretion from a human pancreatic fistula after an operation for cyst has been examined. The proportions of water, dry residue, nitrogen, coagulable proteids, globulins, albumins, and the specific gravity agree fairly closely with previous analyses by Schumm and by Glaessner. With regard to ferments, the secretion was far less active than Glaessner's normal pancreatic juice, but from a qualitative point of view was very similar. A few experiments have been made in order to determine the effect of different foods on the secretion. It appears that starchy foods diminish the amount of secretion to a considerable extent, and that the greatest secretion is obtained on a mixed diet.

J. J. S.

**Pancreatic Juice rendered Active under the Combined Influence of Colloids and Electrolytes.** LARGUIER DES BANCELS (*Compt. rend.*, 1905, 141, 144—145).—Inactive pancreatic juice is enabled to digest albumin impregnated with a suitable colloid, such as aniline-blue, methyl-violet, or Magdala-red, when electrolytes, such as the nitrates or sulphates of ammonium, calcium, or magnesium, are added.

N. H. J. M.

**Maltase of Pancreatic Juice.** H. BIERRY and E. F. TERROINE (*Compt. rend.*, 1905, 141, 146—147).—Whilst relatively large amounts of normal pancreatic juice are unable to hydrolyse maltose in twenty hours, hydrolysis takes place rapidly in presence of small amounts slightly acidified with acetic acid. Under similar conditions, starch is quickly converted into dextrose.

N. H. J. M.

**Conjugated Glycuronic Acids in Bile.** MANFRED BIAL (*Zeit. physiol. Chem.*, 1905, 45, 258—264).—Subcutaneous injections of menthol were made on a dog with gall fistula, and the presence of thymolglycuronic acid in the bile has been proved. The conjugated acid was precipitated from the bile as its insoluble lead salt, and after

boiling with dilute sulphuric acid gave a distinct odour of thymol and the characteristic bromophenylhydrazone of glycuronic acid. The conjugated acid is decomposed in contact with water and human fæces.

J. J. S.

**The Substance which renders Active the Philocatalase in Animal Tissues.** FR. BATTELLI and Mlle. L. STERN (*Compt. rend.*, 1905, 141, 139—142).—Aqueous extracts of animal tissues, heated to boiling and filtered, contain a substance which almost completely protects catalase from the action of anticatalase.

The different tissues of rabbits examined (liver, pancreas, kidney, blood, and muscles) do not differ materially as regards the amount of the substance; it is almost absent from the spleen, from which anti-catalase is prepared.

N. H. J. M.

**Occurrence of Guanase in the Spleen of Oxen and its Non-occurrence in the Spleen of Pigs.** WALTER JONES (*Zeit. physiol. Chem.*, 1905, 45, 84—91. Compare Abstr., 1904, ii, 625; Jones and Partridge, *ibid.*, i, 838; Schittenhelm, following abstract).—Further experiments show that adenine is completely transformed into hypoxanthine by extract of the spleen from pigs, whilst guanine contained in the same vessel and under exactly the same conditions remains unaltered. With extract of spleen from oxen, both guanine and adenine are decomposed, and only xanthine and uric acid are formed. The conclusion that the transformations of adenine into hypoxanthine and of guanine into xanthine are produced by two distinct enzymes, *adenase* and *guanase*, is thus confirmed. The transformation of hypoxanthine into xanthine and uric acid is attributed to an oxydase.

J. J. S.

**Formation and Decomposition of Uric Acid in Extracts of the Organs of Oxen.** ALFRED SCHITTENHELM (*Zeit. physiol. Chem.*, 1905, 45, 121—151. Compare Abstr., 1904, ii, 752).—Extracts of the spleen, lungs, liver, intestine, muscle, and kidneys of oxen are capable of transforming purine bases into uric acid, and the extracts of kidneys, muscle, and liver can decompose this newly formed uric acid, whereas the spleen and lung extracts cannot do so.

In the case of guanine, this is first transformed into xanthine, and this into uric acid by a xanthine oxydase. With adenine, the stages are probably adenine → hypoxanthine → xanthine → uric acid, and the yield of uric acid is almost quantitative when a good supply of oxygen is used. Thymus extracts can also transform amino- into hydroxy-purines. Since the formation and decomposition of uric acid do not proceed simultaneously in all organs, the two processes must be due to distinct ferments. This conclusion is confirmed by the fact that the ferments may be isolated by distinct methods. The ferment which induces the decomposition of uric acid is termed *uricolase*, or *uricolytic ferment*. Among its final decomposition products are glycine and carbamide.

The different results obtained when whole organs, for instance, pancreas, are left to autolysis may be accounted for by differences in the conditions, such as the presence of acid substances.

J. J. S.



**Non-occurrence in the Spleen and Liver of Oxen of a Ferment which transforms Guanine into Xanthine.** Reply to Jones, Partridge, and Winternitz. ALFRED SCHITTENHELM (*Zeit. physiol. Chem.*, 1905, 45, 152—160. Compare Abstr., 1904, ii, 752; Jones and Partridge, *ibid.*, 1904, i, 838; Jones and Winternitz, this vol., ii, 333; Jones, preceding page).—Further experiments confirm the previous statement, that guanine in presence of oxygen is transformed into uric acid by extracts of the spleen of oxen, and the spleen must therefore contain the same ferment as is present in liver, muscles, &c.

The same results are obtained whether solutions of guanine hydrochloride or of guanine in dilute sodium hydroxide are used. The author considers it unnecessary to assume the presence of two distinct ferments, guanase and adenase, in these organs. [Jones's negative results were obtained with spleen of pigs.] J. J. S.

**The Uricolytic Ferment.** ALFRED SCHITTENHELM (*Zeit. physiol. Chem.*, 1905, 45, 161—165. Compare Wiener, Abstr., 1900, ii, 153; Burian, this vol., ii, 271; Ascoli, *Pflüger's Archiv*, 1898, 72, 340; Schittenhelm, Abstr., 1904, ii, 752, and preceding abstracts).—A good active solution of the uricolytic ferment can be obtained by Rosell's method of precipitation with uranyl acetate. The active properties of the ferment are destroyed by heating at 80—100°. J. J. S.

**Fate of Vanillin in the Animal Body.** Y. KOTAKE (*Zeit. physiol. Chem.*, 1905, 45, 320—325. Compare Preusse, *ibid.*, 1880, 4, 213).—Vanillin is oxidised to vanillic acid, which combines with glycuronic acid to form *glycurovanillic acid*, the barium salt of which,  $C_{14}H_{16}O_{11}Ba$ , has been analysed. The salt has  $[\alpha]_D - 37.94^\circ$ . The acid is precipitated from its solutions by basic lead acetate, does not reduce alkaline solutions of cupric salts, and is hydrolysed when boiled with dilute acids. J. J. S.

**Amounts and Origin of Purine Bases in Human Fæces.** II. MARTIN KRÜGER and ALFRED SCHITTENHELM (*Zeit. physiol. Chem.*, 1905, 45, 14—27. Compare Abstr., 1902, ii, 412).—The fæces are digested with dilute sulphuric acid, neutralised with sodium hydroxide to avoid the large amount of washing necessary when barium hydroxide is used, filtered, and the purine derivatives precipitated by the copper method. This gives too high results, as certain albumins and albuminoses are also precipitated. Good results may be obtained by treating the first copper precipitate with sodium sulphide, boiling the filtrate, and reprecipitating the purine bases by the copper or by the silver method.

The amount of nitrogen in the form of purine bases is not less than 0.186 gram per diem. The purine bases are regarded as mainly derived from the secretive organs, namely, liver, spleen, and pancreas, and also to a certain extent from the epithelium of the intestine.

J. J. S.

## Chemistry of Vegetable Physiology and Agriculture.

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**Malt Oxydase.** WLADIMIR ISSAJEW (*Zeit. physiol. Chem.*, 1905, 45, 331—350. Compare Abstr., 1904, i, 959).—Extracts of barley, malt, or diastase with water, alcohol, or aqueous glycerol contain an oxydase. The extractions are best made with 50 per cent. glycerol, as sterilisation by means of bacteria filters is then unnecessary. The ferment present can oxidise the small amounts of oxidisable substances present in the solution, and also various organic compounds which are added. It is highly probable that three distinct ferments are present, an oxydase, a peroxydase, and a catalase. The oxydase is not readily destroyed by heating the solution in boiling water, but its action is reduced; addition of acids and alkalis produces the same effect. The following compounds are all oxidised: *p*-aminophenol, the di- and trihydroxybenzenes, gallic acid, and potassium gallate. *p*-Aminophenol is oxidised much more readily than quinol, ortho-compounds appear to be oxidised more readily than the corresponding para-, and these more readily than meta-compounds. Potassium gallate is decomposed the most readily. Numerous other compounds (phenols, phenol ethers, sugars, &c.) were examined, but were not oxidised to any appreciable extent.

Malt oxydase is only partially absorbed by animal charcoal at the ordinary temperature. Mercuric chloride or tannin destroys the activity of the oxydase, whereas small amounts of alcohol increase it. Dilute manganous sulphate solutions have no action, and concentrated solutions have a retarding effect.

It appears that the activity of the oxydase in barley increases during the process of malting up to the eighth day, then remains constant, but falls on air-drying, and still further on drying at a high temperature.

J. J. S.

**Assimilation of Free, Elementary Nitrogen by Microorganisms.** J. VOGEL (*Centr. Bakt. Par.*, 1905, 15, ii, 33—53).—A résumé of recent investigations on the subject.

N. H. J. M.

**Bacillus Macerans, a Bacillus which produces Acetone.** FRANZ SCHARDINGER (*Centr. Bakt. Par.*, 1905, 14, ii, 772—781).—The bacillus was first noticed in a nutritive mixture, the chief constituent of which was potato pulp, and was subsequently found in the mud from flax pits. Its chief characteristics are a very considerable power of breaking down vegetable cells, and of fermenting carbohydrates with production of acetone, acetic acid, and formic acid. Lactic and succinic acids are not produced.

*Bacillus macerans* may be appropriately placed in the group of the hay-Bacilli. In the great power of the spores in resisting high temperatures, it closely resembles the hay-potato bacillus.

N. H. J. M.

**Decomposition of Fats.** OTTO RAHN (*Centr. Bakt. Par.*, 1905, 15, ii, 53—61).—Only few bacteria are known which decompose fats; the property is more common in the case of mould-fungi. Fatty acids are equally consumed by bacteria, whilst moulds more readily attack the lower fatty acids. The oxidation of acids seems always to be complete without formation of secondary products.  
N. H. J. M.

**Formation of Hydrogen Sulphide by Yeast.** RICHARD SCHANDER (*Bied. Centr.*, 1905, 34, 553—556; from *Jahresber. Verein. Vertreter angew. Bot.*, 1903—1904, 85—121).—Yeasts produce hydrogen sulphide from free sulphur and sulphur compounds; sulphates are more readily decomposed than organic sulphur compounds. In addition to hydrogen sulphide, organic compounds containing sulphur (probably mercaptols) are produced.

The activity of yeasts is stimulated by sulphates, and especially by free sulphur.  
N. H. J. M.

**The Acidity of Milk.** C. J. KONING (*Milchw. Zentr.*, 1905, 1, 289—305; 337—356).—No relation exists between the acidity and the total number of bacteria contained in a sample of ordinary milk, and the loss of carbon dioxide is not balanced by the production of lactic acid. Only when the acidity exceeds a certain limit does the acidity during a certain phase correspondingly increase with the number of bacteria growing in that phase. The relation is also observed when sterilised milk is inoculated with lactic acid bacteria. The age of a sample of milk cannot be arrived at from an estimation of the rise in acidity when the milk is kept at a fixed temperature for a certain number of hours, the so-called age of milk depending on the development of the bacterial flora, and being but little influenced by time.  
W. P. S.

**Sterilisation of Milk with Hydrogen Peroxide, with Special Reference to Budde's Process.** MISTISLAW LUKIN (*Centr. Bakt. Par.*, 1905, 15, ii, 20—32).—The action of hydrogen peroxide diminishes as the acidity increases; it is greater at 37° than at the ordinary temperature. Sterilisation of milk merely by addition of hydrogen peroxide is not practicable. The ordinary 3 per cent. preparation would have to be used in quantities which involve considerable dilution of the milk.

In Budde's method, the warming of the milk to 52° enables the quantity of hydrogen peroxide to be reduced considerably, the amounts required being 0.03 to 0.05, according to the amount of bacteria present.

Experiments with inoculated milk showed that the hay-bacillus, *Streptococcus pyogenes*, and *Bacillus coli commune* are all destroyed by Budde's method.

Different substances have been suggested for removing the hydrogen peroxide from the sterilised milk, but further experiments are necessary.  
N. H. J. M.



**Development of Green Plants in Light, in Absence of Carbon Dioxide, in an Artificial Soil containing Amides.** JULES LEFÈVRE (*Compt. rend.*, 1905, 141, 211—213).—Plants grew normally without carbon dioxide in ignited sand, containing, in addition to Detmer's mineral food, a mixture of tyrosine (0.1), glycine (0.4), alanine (0.4), oxamide (0.1), and leucine (0.1 gram to 350 grams of sand). No carbon dioxide was liberated from the organic matter present.

N. H. J. M.

**Chemical Composition of the Cell Membrane in various Cryptogams.** KARL MÜLLER (*Zeit. physiol. Chem.*, 1905, 45, 265—298. Compare Schulze, *Abstr.*, 1890, 283; 1892, 907; 1894, ii, 250; Gilson, *ibid.*, 1895, i, 323; ii, 323, 408; Winterstein, 1896, ii, 210).—The following have been examined: Algæ—*Cladophora glomerata*. Lichens—*Cladonia rangiferina*, *Cetraria islandica*, *Evernia prunastri*, *Ramalina fraxinea*. Liverworts—*Leioscyphus* (*Jungermannia*) *Taylori*, *Mastigobryum trilobatum*. Mosses—*Sphagnum cuspidatum*, *Polytrichum commune*. The nature of the cell membrane was determined by an examination of the products of hydrolysis. The chief constituents are celluloses, either dextrose-cellulose or mannose-cellulose, and hemicelluloses, such as xylan, galactan, dextran, araban, methylpentosan. Chitin is present in small quantities in *Cladonia* and *Evernia*. *Evernia* (compare Stüde, *Annalen*, 131, 241) has the composition  $C_7H_{15}O_6$ .

J. J. S.

**Nature of the Cyanogenetic Glucoside of the Elder.** L. GUIGNARD and JULES HOUDAS (*Compt. rend.*, 1905, 141, 236—238. Compare this vol., ii, 604, and Bourquelot and Danjou, *ibid.*, ii, 605).—The authors conclude that the cyanogenetic glucoside contained in the leaves of the elder (*Sambucus nigra*) is amygdalin, since the aqueous liquid obtained by macerating the comminuted leaves in water and distilling in a current of steam contains benzaldehyde, identified by means of its semicarbazone.

T. A. H.

**Coffee Seeds without Caffeine.** GABRIEL BERTRAND (*Compt. rend.*, 1905, 141, 209—211).—The seeds of different species of coffee contain 1 to 1.5 per cent. of caffeine. *Coffea Humblotiana*, which is very similar to *C. arabica*, does not contain, however, any trace of caffeine, and this is also true of three new species, *C. Gallienii*, *C. Bonnierii*, and *C. Mogeneti*.

The absence of caffeine is not due to conditions of soil or climate, since *Coffea arabica* grown under the same conditions was found to contain 1.34 per cent.

N. H. J. M.

**Quantitative Investigation of the Distribution of the Alkaloids in the Organs of Datura Stramonium.** JULIUS FELDHAUS (*Arch. Pharm.*, 1905, 243, 328—348).—This paper is of interest chiefly from the standpoint of physiological botany. The percentage of alkaloid in the dried material varied from 1.39 in the ribs of the leaves to 0.082 in the ripe pericarps, 0.9 in the main stem, and

0.10 in the main root; in most parts the percentage lay between 0.3 and 0.6.

In the case of the seeds, the percentage varied from 0.21 to 0.48, according to the locality (in Germany and Switzerland) from which the drug was procured; it varies also with the year, having been 0.33, 0.48, and 0.34 in the case of seed harvested at Marburg in the years 1900, 1901, and 1902 respectively.

C. F. B.

**Weathered Hay.** WALTER F. SUTHERST (*Chem. News*, 1905, 92, 61).—Hay exposed to rain loses carbohydrates, amino-compounds, and ash constituents.

D. A. L.

**Pond Feeding Experiments at Hellendorf and Geeste in 1903.** W. CRONHEIM and E. GIESECKE (*Bied. Centr.*, 1905, 34, 543—546; from *Fisch. Zeit.*, 1904, 7, No. 42).—The foods employed were crushed maize, barley, blue lupins, or fish meal, and it was found advantageous to continue feeding in September when the weather continues to be warm. The amount of food consumed was 3.956 kilograms per kilogram of fish. Application of manure is desirable.

As regards mineral food, calcium and phosphoric acid are sufficiently abundant under ordinary conditions; it may, however, be desirable to supply potassium either in the food or as manure.

N. H. J. M.

**New Apparatus for Determining the Ammonia-absorption Power of Soils.** FERDINAND WOHLTMANN and PH. SCHNEIDER (*Chem. Zeit.*, 1905, 29, 810—811).—The dry material is brought into contact with dry ammonia, and the absorption is measured by the rising of the mercury in the graduated tube. For a description of the apparatus, the original paper and illustration must be consulted.

L. DE K.

**Influence of Fat and other Substances on Milk Production when given in Addition to a Scanty Basal Food.** AUGUST MORGEN, CARL BEGER, and GUSTAV FINGERLING (*Landw. Versuchs-stat.*, 1905, 62, 251—386).—Addition of fat (earth-nut oil) in suitable quantity is especially suitable for the production of milk-fat, and probably no other kind of food has a similar effect. Proteids are favourable to milk production, but have no specific action on the production of milk-fat. Carbohydrates have no effect on the yield or on the production of milk-fat.

The refractometer number of the fat of milk is raised by addition of fat to the food.

The three kinds of food (fat, proteids, and carbohydrates) do not show any marked differences as regards effect on live weight.

Addition of moderate amounts of fat to a normal food considerably increases the yield of milk, and also increases the percentage of fat in the milk by 0.14 per cent. Larger amounts of fat give a considerable further increase in the amount of milk, but vary in their action on the production of fat, being sometimes favourable and sometimes unfavourable.

N. H. J. M.

**"Basic Slag-ammonia," a New Manure ; its Composition and Results of Manurial Experiments in 1904.** MÜLLER (*Bied. Centr.*, 1905, 34, 513—514 ; from *Illust. landw. Zeit.*, 1905, 25, 303).—The manure is prepared from basic slag or superphosphates and ammonium salts. The results of experiments with wheat, oats, potatoes, mangolds, and rye, in which the manure (from basic slag) was compared with sodium nitrate, basic slag, and potassium salts, were very satisfactory. The manure should not be ploughed in deep, but applied as a top dressing.

If soon used, the manure loses very little nitrogen. N. H. J. M.

**Manurial Experiments at the Agricultural Experiment Station, Marburg.** E. HASELHOFF (*Bied. Centr.*, 1905, 34, 515—518 ; from *Jahresber. landw. Versuchs-stat. Marburg*, 1904—5).—Experiments with calcium cyanamide showed that germination is affected by the presence of 0.025 gram per 100 grams of soil. Injury is, however, avoided if the calcium cyanamide is applied some time before sowing the seed. In field experiments, the manure gives good results. "Basic slag-ammonia" gives good results both as a phosphatic and a nitrogenous manure, but its employment is not recommended owing to the loss of nitrogen which it must undergo (compare preceding abstract). N. H. J. M.

**Manurial Value of Molasses as compared with Ammonium Sulphate and 40 per cent. Potassium Salts.** LILIENTHAL (*Bied. Centr.*, 1905, 34, 514—515 ; from *Illust. landw. Zeit.*, 1905, 25, 319).—The dried molasses contain  $N = 3.5$  and  $K_2O = 13$  per cent., but no phosphoric acid. As compared with ammonium salts and 40 per cent. potassium salts, the manure gives favourable results with respect to the quality of potatoes ; the yield of potatoes is about the same in both cases. N. H. J. M.

**Function of the Sodium when used in Sodium Nitrate.** HOMER J. WHEELER, BURT L. HARTWELL, and G. E. ADAMS (16th *Ann. Rep. Rhode Island Agr. Exper. Stat.*, 1902—3, 237—267).—Plant growth is greatly influenced by the chemical reaction of the soil, or by compounds formed as a result of the reaction. Sodium nitrate leaves a basic residue owing to the nitrogen being appropriated by the plant, whilst for the same reason ammonium sulphate leaves an acid residue. Differences in yields produced by ammonium sulphate and sodium nitrate are attributed chiefly to this difference in chemical reaction produced in the soil. N. H. J. M.

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## Analytical Chemistry.

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**Simplified Elementary Analysis and its Technical Application.** MAXIMILIANO DENNSTEDT (*Zeit. angew. Chem.*, 1905, 18, 1134—1137. Compare Abstr., 1903, ii, 103; this vol., ii, 202).—The author demonstrates the applicability of his method of elementary analysis to various technical products such as coal, mineral oils, and pyrites.

Heraeus' electric combustion furnace may also be modified as described in the paper. A. McK.

**Apparatus for Generation of Hydrogen Sulphide, &c.** HEINRICH BILTZ (*Chem. Zeit.*, 1905, 29, 809).—A Clement-Winkler's apparatus of larger size and made of stoneware. Any suitable acid may be used. L. DE K.

**Titrimetric Estimation of Chlorates and Bromates.** MAX SCHOLTZ (*Arch. Pharm.*, 1905, 243, 353—358).—Of the chlorate 0.2—0.3 gram, or of the bromate 0.3—0.4 gram, is dissolved in about 100 c.c. of water, 10 c.c. of nitric acid of sp. gr. 1.2 and 10 c.c. of a 10 per cent. solution of sodium nitrite are added, and the whole is allowed to remain at the ordinary temperature for ten to fifteen minutes in the case of the chlorate, for five minutes in the case of the bromate. Then a measured excess, say 30 c.c., of  $N/10$  silver nitrate solution is added and 5 c.c. of a saturated solution of iron alum, and the excess of silver is titrated with  $N/10$  ammonium thiocyanate solution. Of the  $N/10$  silver solution, 1 c.c. = 0.012245 gram of potassium chlorate or 0.0167 gram of potassium bromate. The nitrous acid reduces the chloric or bromic acid formed to hydrochloric or hydrobromic acid. Iodic acid is not reduced by nitrous acid.

C. F. B.

**Assay of Concentrated Nitric Acids by the Specific Gravity.** GEORG LUNGE (*Chem. Zeit.*, 1905, 29, 933—934).—A detailed reply to Winteler (this vol., ii, 553). The sp. gr. tables constructed by the author and Rey (Abstr., 1892, 11, 13) give perfectly correct results, and their accuracy has since been confirmed by Veley and Manley (Trans., 1903, 85, 1015) and others. Hyponitric acid should, of course, be allowed for. L. DE K.

**Electrolytic Estimation of Small Quantities of Arsenic.** HEINRICH FRERICHS and G. RODENBERG (*Arch. Pharm.*, 1905, 243, 348—353).—The mixture of hydrogen with hydrogen arsenide is generated in an apparatus similar to that of Trotman (Abstr., 1904, ii, 291), except that the perishable parchment diaphragm is replaced by a

porous cup, cut from the end of a clay battery cell, into which is cemented a glass tube which surrounds the cathode and is fitted above with an india-rubber stopper pierced by a delivery tube, &c. The issuing gas passes first through a small tube containing pumice moistened with lead acetate, and then into an absorption tube containing ammoniacal standard silver nitrate solution; this solution is finally acidified with nitric acid, and the excess of silver is titrated with thiocyanate. The absorption tube has the form of a U-tube with a large bulb at the bottom of each limb, these being connected by a narrow tube rising slightly, on which 5 or 6 small bulbs are blown. This part of the apparatus, as well as the method, has been employed by Mai and Hurt; but whereas with their cell electrolysis for three hours is necessary when 0.02 gram of arsenious oxide is present, half an hour suffices with the cell just described. In the case of arsenic acid, it is better first to reduce this with sulphurous acid to the arsenious state; otherwise electrolysis for at least three hours is necessary. A current of 2—3 amperes at a pressure of 16 volts was employed.

C. F. B.

**Estimation of Arsenic as Magnesium Pyroarsenate.** JUAN FAGES VIRGILI (*Zeit. anal. Chem.*, 1905, 44, 492—516).—The results obtained by this method are too low unless particular precautions are taken in igniting the precipitate of magnesium ammonium arsenate and the filter on which it has been collected. The solubility of the precipitate in the wash-water should also be taken into account. The author finds it better to dissolve the precipitate off the filter with nitric acid, evaporate the solution, and ignite the residue obtained. Each 100 c.c. of solution and ammoniacal wash-water dissolves an amount of ammonium magnesium arsenate corresponding with 0.0013 gram of arsenic (As), and this correction must be applied to the final results. If, however, not less than 250 c.c. or more than 350 c.c. of solution and wash-water be used for each 0.1 gram of arsenic, the correction may be neglected, as the impurities occluded by the precipitate compensate for the solubility.

W. P. S.

**Occurrence of Boric Acid in Common Salt.** RUDOLF HEFELMANN (*Zeit. öffentl. Chem.*, 1905, 11, 231—234).—Although the salt obtained from some Italian and Swiss mines undoubtedly contains boric acid, the quantity of the latter present is extremely small, varying from 0.0006 to 0.0030 per cent. The quantity of boric acid introduced into foods by the use of this salt is too minute to be detected by the usual tests.

W. P. S.

**Separation of Metals by Volatilisation in a Current of Hydrochloric Acid Gas.** CARL FRIEDHEIM and LUDWIG JACOBUS (*Zeit. anal. Chem.*, 1905, 44, 465—491).—Results are given of a number of separations of metals by this method, which was originally proposed by Jannasch (*Abstr.*, 1895, ii, 89, 462). The process consists in heating a mixture of the oxides or salts of the metals in a current of pure dry hydrogen chloride. The volatile chloride collected

in the receiver of the apparatus and the residue in the decomposition vessel are then separately estimated. The separations carried out by the authors were: arsenic from lead, arsenic from copper, arsenic from iron, tin from lead, tin from copper, tin from iron, bismuth from lead, bismuth from copper, and bismuth from cobalt and nickel. In almost all cases appreciable quantities of the volatile metal remain in the non-volatile residue. The best results are obtained in the separation of tin from copper, practically quantitative results being yielded.

W. P. S.

**Detection and Estimation of Sodium in Presence of Lithium by means of Hydrofluosilicic Acid.** C. REICHARD (*Chem. Zeit.*, 1905, 29, 861—862).—Not only potassium, but also sodium, may be quantitatively precipitated by means of hydrofluosilicic acid, whilst lithium is not at all affected. The respective precipitates are then ignited (the filter being burnt separately) and weighed as silicofluorides.

In case both potassium and sodium are present, the mixed precipitate is heated with a little hydrofluoric acid and sulphuric acid and finally weighed as mixed sulphate. After estimating the sulphur trioxide contained therein, the amount of the respective metals may be found by the usual calculation.

L. DE K.

**Electrolytic Estimation of Zinc.** K. JENE (*Chem. Zeit.*, 1905, 29, 803—804).—0.5 gram of zinc ore is dissolved in nitro-hydrochloric acid, the solution is evaporated to dryness, and the residue heated with 1—2 c.c. of dilute sulphuric acid (1:1) until fumes appear. When cold, the mass is taken up with boiling water and filtered. The filtrate and washings, which need not exceed 80—100 c.c., are placed in a weighed copper-coated platinum dish, 4—7 grams of sodium hydroxide having first been added. Neglecting any undissolved metallic hydroxides, the liquid is at once submitted to electrolysis at a temperature of 50°, using 1 ampere and a potential difference of 3.8—4.2 volts. The zinc is completely deposited within 1½—2 hours. Without interrupting the current, the dish is well rinsed, first with cold water and then with absolute alcohol. After drying for a few minutes in the air-bath, the dish is reweighed.

L. DE K.

**Rapid Method for the Detection of Traces of Zinc in Worts, Beer, Wine, &c.** J. BRAND (*Chem. Centr.*, 1905, ii, 515; from *Zeit. ges. Brauw.*, 28, 438—440).—Five hundred c.c. of the sample are slightly acidified with hydrochloric acid, and a few drops of potassium ferrocyanide are added. If no precipitate forms, zinc is absent, but if there is any precipitate this should be collected and incinerated on a platinum lid. The ash is then digested with acetic acid and tested for zinc with hydrogen sulphide.

L. DE K.

**Titration of Ferrous Iron with Permanganate in Presence of Hydrochloric Acid.** GREGORY P. BAXTER and HARRY LOUIS FREVERT (*Amer. Chem. J.*, 1905, 34, 109—116).—Baxter and Zanetti (this vol., ii, 490) have shown that oxalic acid may be accurately



titrated with permanganate in presence of free hydrochloric acid without addition of manganous sulphate, provided the temperature at the beginning of the titration is above  $70^{\circ}$ .

The authors prove by a series of experiments that ferrous iron cannot be accurately titrated with permanganate unless about one gram of manganous sulphate is added; the temperature may then be raised even to  $95^{\circ}$ .

Fairly accurate results may, however, be obtained without addition of manganous sulphate by titrating with permanganate at  $80-90^{\circ}$  in presence of but little free hydrochloric acid, and afterwards applying a negative correction of 0.3 per cent.

L. DE K.

**Estimation of Metallic Iron in Ferrum Redactum.** A. CHRISTENSEN (*Zeit. anal. Chem.*, 1905, 44, 535—540).—An accurately weighed portion of about 0.5 gram of the sample is placed in a 100 c.c. flask which has previously been filled with carbon dioxide. Fifty c.c. of neutral ferric chloride solution, prepared by dissolving 1 part of anhydrous ferric chloride in 10 parts of water, are added, the flask is closed, and shaken for twenty minutes. The volume is then made up to 100 c.c. with boiled water, and the contents of the flask well mixed. After standing for twenty-four hours, 20 c.c. of the clear supernatant solution are withdrawn, transferred to a flask containing 50 c.c. of 10 per cent. sulphuric acid and filled with carbon dioxide, and titrated with  $N/10$  potassium permanganate solution. The volume of the latter required corresponds with the quantity of ferrous chloride produced by the reaction, and the amount of metallic iron present is calculated from the equation  $\text{Fe} + 2\text{FeCl}_3 = 3\text{FeCl}_2$ .

W. P. S.

**Gasometric Estimation of Metallic Iron in Ferrum Redactum.** FERDINAND BARMWATER (*Zeit. anal. Chem.*, 1905, 44, 541—543).—About one gram of the sample is weighed out into a small test-tube and placed in an evolution flask of 400 c.c. capacity, provided with an india-rubber stopper through which pass two glass tubes. One of these tubes is connected with a U-shaped gas-measuring tube. The latter has two bulbs blown on the limb next the evolution flask and is graduated, the volume of gas which the limb will hold being about 500 c.c. The other limb is narrow and carries a side-tube which serves as a siphon for levelling the water with which the tube is filled. At the commencement of the estimation, the evolution flask is filled with hydrogen after first adding the necessary volume of 20 per cent. sulphuric acid. Both flask and measuring tube are surrounded by vessels containing water. The *ferrum redactum* in the test-tube is brought into contact with the acid in the flask and the evolved hydrogen collected in the measuring tube. The reaction is completed by heating the water surrounding the flask. When no more gas comes over, the flask is allowed to cool to the initial temperature, and the volume of the collected gas read off after bringing the level of the water in both limbs of the tube to the same height. From the volume of gas obtained, the amount of metallic iron in the sample may be calculated.

W. P. S.

**Estimation of Antimony as Trisulphide and the Separation of Antimony from Tin.** GEORG VORTMANN and A. METZL (*Zeit. anal. Chem.*, 1905, 44, 525—535).—Hydrochloric acid is added to the solution containing the antimony in the proportion of 24 c.c. of the concentrated acid to each 100 c.c. of the neutral solution. The mixture is then heated to boiling and treated with a current of hydrogen sulphide gas. The yellow sulphide, which is at first precipitated, gradually becomes red, then brown, and finally black and crystalline. An equal volume of water is now added and a little more hydrogen sulphide passed through the solution. The precipitate is collected on a tared filter, washed with water, then with alcohol, and dried. Small quantities of free sulphur contained in the precipitate may be removed by extraction with carbon disulphide. After again drying, the precipitate is weighed. An alternative method consists in placing the moist filter and precipitate in a crucible, and adding about three grams of a mixture of three parts of ferric oxide with one part of ferric nitrate. The crucible and its contents are then cautiously heated, the flame being increased to a blast at the end of the operation. The quantity of residue left by the iron mixture is found by a previous experiment and subtracted.

Antimony may be quantitatively separated from tin by dissolving the mixed sulphides in a little hydrochloric acid (1:1), neutralising the solution by the addition of sodium hydroxide, and diluting to a volume of 60 c.c. An equal volume (60 c.c.) of phosphoric acid of sp. gr. 1.3 and 24 c.c. of concentrated hydrochloric acid are then added and the solution treated at the boiling temperature with hydrogen sulphide. The black precipitated antimony trisulphide is collected and weighed as previously described. The filtrate containing the whole of the tin in solution is nearly neutralised, diluted with an equal volume of water, warmed, and the tin precipitated as the sulphide in the usual manner.

W. P. S.

**Estimation of Ethyl and Methyl Alcohol in Mixtures by the Immersion Refractometer.** ALBERT E. LEACH and HERMANN C. LYTHGOE (*J. Amer. Chem. Soc.*, 1905, 27, 964—972).—Whilst the U.S.P. spirit containing 91 per cent. by weight of absolute ethyl alcohol gives a reading of 98.3° at 20° with the immersion refractometer, a 91 per cent. methyl alcohol only gives a reading of 14.9°.

In order to detect methyl alcohol in, for example, tinctures, these are subjected to distillation, and the joint ethyl and methyl alcohols are found from the sp. gr., as there is practically no difference in density between the two alcohols. If, now, the result obtained by the refractometer corresponds with that calculated from the sp. gr. (the authors use Hehner's tables), the spirit is pure, but if decidedly lower, methyl alcohol is present and its amount may be calculated by referring to the tables in the original.

L. DE K.

**Action of Aldehydes on Mercuric Oxide in Alkaline Solution. Distinction between Acetaldehyde and Formaldehyde.** ALEXANDRE LEYS (*J. Pharm. Chim.*, 1905, [vi], 22, 107—112).—A solution of one gram of mercuric oxide dissolved by gentle warming in

100 c.c. of a freshly prepared 5 per cent. solution of sodium sulphite after filtering out of contact with ammoniacal vapours, forms a reagent for aldehydes containing the  $-\text{CH}_2\cdot\text{CHO}$  group, and may therefore be used for distinguishing acetaldehyde from formaldehyde. The reagent, treated with a few drops of dilute acetaldehyde solution and an equal volume of very dilute sodium hydroxide, produces in the cold a heavy white precipitate, to which the formula  $\text{Hg}\cdot\text{CH}\cdot\text{CH}\langle\text{O}\rangle\text{Hg}$  is assigned; alcohol may be added if necessary to keep the aldehyde in solution. Terpenes are the only substances producing a similar precipitate under those circumstances. Acetone and acetylacetone also produce precipitates, but only on warming. P. H.

**Indirect Estimation of Aldehydes in Oil of Lemon.** ENRICO BERTÉ (*Chem. Zeit.*, 1905, 29, 805—806).—The percentage of aldehydes in oil of lemon may be calculated by means of the formula  $C = \frac{100(A - a)}{A}$ , in which  $a$  represents the polarisation of the sample,  $A$  the polarisation of the sample freed from aldehydes, and  $C$  the percentage of aldehydes.

The oil is deprived of aldehydes by heating 10 c.c. of the sample for fifteen minutes with 50 c.c. of a saturated solution of potassium hydrogen sulphite in a boiling water-bath with constant shaking. To prevent volatilisation, the flask is fitted with a cork, through which passes a tube 40—45 cm. long. Finally, the supernatant oil is decanted, washed with a little water, and then dried over a little anhydrous sodium sulphate. A large number of experiments are communicated.

L. DE K.

**Polarimetric Determination of Sucrose.** FRANCIS WATTS and HAROLD A. TEMPANY (*West Indian Bulletin*, 1905, 6, 52—60).—In reading sucrose solutions in the polarimeter at tropical temperatures, the authors recommend, when no clarifying reagent is necessary, the solution of 26 grams of the sugar in 100 true c.c. of water. The correction for the temperature change of the quartz is then made by Jobin's formula, and that for the change of the polarisation by the formula: polarisation +  $0\cdot00023tN$ , where  $t$  is the difference between the temperature of observation and that at which the instrument was standardised, and  $N$  is the Ventzke-Scheibler reading observed. Both corrections may be made by the formula: polarisation +  $0\cdot00039tN$ .

When clarification by means of lead acetate is necessary, a very considerable error is introduced if no account is taken of the volume occupied by the lead precipitate. A method which obviates this error, and which is yet much simpler than the actual direct or indirect measurement of the volume of the precipitate, has been given by Horne (*Abstr.*, 1904, ii, 451). It consists in making the solution up to 100 c.c. and then adding dry anhydrous basic lead acetate, excess of which should be avoided. This procedure leads to results approximating closely to the truth.

T. H. P.



### Influence of Invert Sugar on the Estimation of Crystallisable Sugar with Reference to the Yield of Refined Sugar.

MAXIME CARIMANTRAND (*Bull. Soc. chim.*, 1905, [iii], 33, 795—799).—The author finds that, contrary to the opinion recently published, uncrystallisable sugar (invert sugar) diminishes the rotatory power of crystallisable sugar to which it is added, and that, consequently, Clerget's method is the one giving most exactly the proportions of the two sugars present. If tartaric acid is used for the inversion, the temperature and time have little influence on the inverted products, sugar syrups of 40° B. being quite colourless when completely inverted. Inversion with tartaric acid is the more rapid and complete the nearer the sp. gr. of the solution is to 35—36° B. With 10 per cent. sugar solutions, inversion is slow, and it does not take place at all with cane molasses containing a large proportion of invert sugar.

The proportion of uncrystallisable sugar in raw sugars is nearly always less than 5 per cent., so that inversion with tartaric or hydrochloric acid is unnecessary, since this amount does not appreciably influence the rotation of the sucrose. When, however, the proportion of invert sugar reaches 10 per cent. or more, the sugar should be first defecated with basic lead acetate and Clerget's method then employed.

T. H. P.

**Detection of Wood-fibre.** W. HERZBERG (*Chem. Centr.*, 1905, ii, 359—360; from *Mitt. K. Materialprüfungsamt*, 1904, 22, 293—294).

—The test for wood pulp in paper with phloroglucinol is somewhat interfered with by the presence of colouring matter, such as metanil-yellow. Spots caused by metanil-yellow are, however, of a more uniform colour than those caused by wood-fibre; they also fade much more quickly and show a violet zone. In case of doubt, the paper is moistened with hydrochloric acid, and if this gives no colour the reaction with phloroglucinol is due to wood-fibre. If the acid should give a red spot, recourse should be had to a microscopical examination.

L. DE K.

**Saponification of Beeswax.** F. SCHWARTZ (*Zeit. öffentl. Chem.*, 1905, 11, 301—302).—A reply to Cohn (*ibid.*, 58). The author again states that one hour's boiling with an  $N/2$  solution of potassium hydroxide in absolute alcohol is sufficient for the complete saponification of the wax. It is also recommended to add more alcohol before titrating the excess of alkali with  $N/2$  hydrochloric acid so as to prevent a dissociation of the soap by the water introduced.

L. DE K.

**Rosin Spirit, Pine Wood Oils, and Turpentine.** EDUARD VALENTA (*Chem. Zeit.*, 1905, 29, 807—808).—Rosin spirit (pinolin) may be detected in commercial turpentine by collecting the fraction distilling below 160° and applying the following reaction. One part of the distillate is mixed with 1—2 parts of a 6 per cent. solution of iodine in chloroform or carbon tetrachloride, when in the presence of pinolin a green or olive-green coloration is obtained on warming. The same green colour is obtained on adding acetic anhydride and a drop of

sulphuric acid. Pine wood oils, which are really only turpentine contaminated with empyreumatic products, may be identified by their reducing action on a solution of gold chloride. If 5 c.c. of a 10 per cent. solution of potassium iodide is shaken with 10 c.c. of fresh turpentine and 10 c.c. of carbon disulphide, a yellow potassium iodide layer and a rose-coloured oily layer are obtained. Pine wood oils yield a yellowish-red oily layer. Rosin spirit, petroleum, and rosin oil give more or less pale-yellow oily layers. In the case of pine wood oils the oily layer also becomes turbid.

For further reactions, the tables in the original paper should be consulted.

L. DE K.

**Detection of Salicylic Acid in Foods.** FELICE GORNI (*Chem. Centr.*, 1905, ii, 519; from *Boll. Chim. Farm.*, 44, 409—414).—The presence of lactic and other organic acids interferes with the ferric chloride test for salicylic acid. In order fully to ensure the absence of these acids, it is recommended to extract the salicylic acid not with pure ether, but with a mixture of equal volumes of ether and light petroleum.

L. DE K.

**Estimation of Glycuronic Acid.** CARL NEUBERG (*Zeit. physiol. Chem.*, 1905, 45, 183—184).—Polemical (compare Tollens, this vol., ii, 559).

J. J. S.

**The True Dropping Point and an Apparatus for Determining it.** LEO UBBELOHDE (*Zeit. angew. Chem.*, 1905, 18, 1220—1225).—Objection is raised to Pohl's and to Finkener's methods for determining the dropping point of fats, &c. The true dropping point is defined as the temperature at which a single drop separates under the influence of its own weight from a mass of the substance which has been uniformly heated, and the amount and weight of which do not influence the drop.

An apparatus for determining the true dropping point is described.

A. McK.

**Detection and Estimation of Antipyrine in Pyramidone.** GUSTAVE PATEIN (*J. Pharm. Chim.*, 1905, [vi], 22, 5—8).—A test originally proposed by Bourcet may be used for the detection of antipyrine. 0.2 gram of the sample is dissolved in 5 c.c. of water and treated with two drops of sulphuric acid and a few crystals of sodium nitrite. In the case of pure pyramidone, an intense bluish-violet coloration is obtained, which rapidly fades, leaving the solution colourless. Should, however, as little as 2 per cent. of antipyrine be present, a permanent bluish-green coloration is visible after the violet colour due to the pyramidone has faded away.

The method described for the estimation of antipyrine is based on the precipitation of this substance by means of formaldehyde. One gram of the sample is treated with 5 c.c. of water, 5 c.c. of hydrochloric acid, and 2 c.c. of a 40 per cent. formaldehyde solution. After four hours, the precipitate which is obtained if antipyrine is present is collected on a small filter, washed with cold water, dried, detached

from the filter, and weighed. The weight of this precipitate represents from 90 to 100 per cent. of the antipyrine present in the sample. The pyramidon in the filtrate may be obtained by shaking out the latter with chloroform and evaporating the chloroform solution at a low temperature. The method gives approximate results. W. P. S.

**Alkaloid Reactions.** C. REICHARD (*Chem. Centr.*, 1905, ii, 172 ; from *Pharm. Zeit.*, 50, 430—431. Compare this vol., ii, 561, 563).—*Quinine and Cinchonine*.—Some new tests are given for these alkaloids, of which the following are the most characteristic. If quinine sulphate is mixed with powdered ammonium persulphate and the mass carefully moistened with hydrochloric acid, a beautiful green coloration appears, whilst cinchonine is as a rule unaffected. On adding to the acid mixtures a drop of strong potassium thiocyanate, both alkaloids give a dirty-green coloration with a shade of red, which soon changes into yellow. If a mixture of quinine sulphate, potassium ethyl sulphate, and potassium ferrocyanide is heated to incipient fusion, no change is noticed, but in the case of cinchonine the mass becomes a dark blue. If potassium ethyl sulphate is heated with quinine sulphate and hydrochloric acid and then mixed with potassium thiocyanate, no reaction is noticed on introducing into the liquid a clear crystal of potassium ferrocyanide, but with cinchonine sulphate the crystal becomes a fine ruby-red ; this reaction, however, is not always successful. If a mixture of quinine sulphate and sodium picrate is moistened with a drop of water and then dried, the mass on being moistened with a drop of concentrated potassium thiocyanate solution assumes a splendid and permanent orange-red colour ; cinchonine only gives a passing faint orange coloration. L. DE K.

**Estimation of the Active Principles of Alder Bark and Cascara Sagrada and their Extracts.** JULES WARIN (*J. Pharm. Chim.*, 1905, [vi], 22, 12—14).—The method previously described (*Abstr.*, 1905, ii, 363) for the examination of alder bark is not applicable to *Cascara sagrada*, as the latter contains hydroxymethylanthraquinone compounds which are not directly soluble in alkaline solutions. The powdered bark must be heated for two hours with 2 per cent. sulphuric acid at a temperature of 100°, cooled, extracted (powder and solution) many times with ether, and the united ethereal solutions shaken out with 2 per cent. sodium hydroxide. The alkaline solution obtained serves for the colorimetric estimation as described for alder bark. These methods may be also used for the analysis of the extracts of the above-mentioned barks. Alder bark was found to contain 3.5 per cent. of active principle (as emodin) and the extract 0.755 per cent., whilst *Cascara sagrada* containing 0.605 per cent. of emodin yielded bitter and non-bitter extracts containing 0.590 and 0.595 per cent. respectively. W. P. S.

**Easy Way of Distinguishing English from Chinese Rhubarb.** ALEXANDER TSCHIRCH (*Chem. Centr.*, 1905, ii, 82—83 ; from *Schweiz. Woch. Pharm.*, 43, 253—254).—English rhubarb (*Rheum Rhaponticum*) is distinguished from the Chinese variety by containing a well-



crystallised glucoside *rhaponticin* insoluble in ether. Ten grams of the suspected root are boiled for 15 minutes with 50 c.c. of dilute alcohol, the filtrate is concentrated to 10 c.c., and when cold it is shaken with 10—15 c.c. of ether. The extract from true rhubarb is still clear after 24 hours, but if the *Rhaponticum* variety has been substituted a decided deposit of prismatic needles will have formed. These crystals may be further identified by moistening with sulphuric acid, which produces a purple coloration changing to orange.

L. DE K.

**Beer Analysis by means of the Refractometer.** GEORG BARTH (*Chem. Centr.*, 1905, i, 1747; from *Zeit. ges. Brauw.*, 28, 303—306).—If  $x$  represents the amount of alcohol,  $y$  the amount of extract in a beer,  $r$  the refraction difference, and  $s$  the difference in sp. gr. of the beer and water, we have:  $x = 0.03366r + 0.001303s$ .  $y = 0.007598r - 0.002923s$ . The correctness of these formulæ was fully confirmed.

L. DE K.

**Estimation of Extract in Malt.** C. BLEISCH and P. REGENSBURGER (*Chem. Centr.*, 1905, i, 1747; from *Zeit. ges. Brauw.*, 28, 313—316).—A slight modification of the usual process. The malt is mashed as usual, and when saccharification has set in, the whole is boiled over an asbestos millboard for twenty minutes. When cooled to 65°, 10 c.c. of a fresh green malt extract are added and the whole is kept at 65—70° for ten minutes.

L. DE K.

**Estimation of Bacillus Coli in Potable Waters.** ALBERT GAUTIÉ (*Ann. Chim. anal.*, 1905, 10, 254—257).—The author has made a slight modification in the usual process for the detection of the *Bacillus coli communis* in waters. This method, as is well known, consists in adding peptone-broth and a sufficient amount of phenol to prevent the growth of a large number of saprophytic germs. Instead of using 100 c.c. of water, the author makes repeated experiments with 100, 80, 50, 20, 10, and 1 c.c. of water, then further trials with 20, 10, 5, and 1 drops of the sample. It is only by such repeated experiments that a fair idea may be obtained as to the quantity of the coli-bacilli. The mere presence of the bacillus is not sufficient to condemn a water. For further details the original paper should be consulted.

L. DE K.

## General and Physical Chemistry.

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**Determination of Refractive Indices of Hydrogen, Carbon Dioxide, and Oxygen in the Infra-red.** JOHN KOCH (*Ann. Physik*, 1905, [iv], 17, 658—674).—An interference method is employed and details are given. For hydrogen for a wave-length =  $8.69\mu$ , the value 1.0001373 at  $0^\circ$  and 760 mm. was obtained, a result in accord with the value 1.000264 obtained by Boltzmann for the dielectric constant. From the values of the refractive index for this and other wave-lengths, the author deduces by Drude's equations (*ibid.*, 1904, 14, 677 and 936) the value  $1.49 \times 10^7$  for the ratio  $e/m$ . For carbon dioxide for the same wave-length, the value 1.0004578 was obtained; this is greater than that for the *D*-line, so that the gas furnishes a case of anomalous dispersion. For oxygen, the value found was 1.0002661, which is less than the values hitherto obtained for the lithium and *D*-lines (1.000271), so that the dispersion is normal. L. M. J.

**Relation between Electrolytic Dissociation and Refractive Power.** FILIPPO ZECCHINI (*Gazzetta*, 1905, 35, ii, 65—86).—The author has made a large number of measurements of the densities and refractive indices for sodium light and at the ordinary temperature of solutions of different concentrations of sulphuric, hydrochloric, nitric, acetic, propionic, trichloroacetic, phosphoric, phosphorous, and hydrofluoric acids, sodium and potassium hydroxides, ammonia, potassium nitrate, chloride, acetate, and trichloroacetate, and ammonium nitrate. The numbers obtained lead to the following conclusions.

The dissociation of sulphuric acid by dilution with water effects only a very small change in the molecular refraction of the acid. With hydrochloric and nitric acids, the molecular refraction increases slightly with the dilution. The increase scarcely ever amounts to 2.2, which should be the value corresponding with the complete ionisation of a hydrogen atom. Leblanc and Rohland's hypothesis, according to which the hydrogen ion has double the refraction of the hydrogen atom, is therefore regarded by the author as not justified, the small deviations of the molecular refraction being equally well attributable to the anion. The values obtained for solutions of the bases examined indicate no difference in refraction between a hydroxyl group and a hydroxyl ion.

In the case of salts, the molecular refraction is mostly independent of the concentration of the solution.

The molecular refraction of the water formed in the neutralisation of an acid by a base varies considerably. For the strong acids (nitric, hydrochloric, sulphuric, and trichloroacetic) with the strong bases, potassium and sodium hydroxides, it varies from a minimum of 7.71 with sodium sulphate to a maximum of 8.40 with potassium trichloroacetate, whilst it has the value 5.97 for ammonium nitrate or potassium acetate. No explanation is advanced for these divergences.

Further researches are necessary before definite conclusions can be arrived at concerning the influence of dissociation on refraction, the views of Ostwald and Leblanc not being confirmed by the results already obtained. T. H. P.

**Chemiluminescence.** MAX TRAUTZ (*Zeit. physikal. Chem.*, 1905, 53, 1—111. Compare Trautz and Schorigin, this vol., ii, 494; also Guinchant, *ibid.*, 366; Gernez, *ibid.*, 430, 431).—The paper contains an exhaustive historical and critical review of the observations made on crystalloluminescence, triboluminescence, and reaction luminescence. Many new cases of crystalloluminescence have been observed, and attention is drawn to the fact that this phenomenon may accompany the separation of crystals from fused masses. The author considers that crystalloluminescence is essentially the same phenomenon as triboluminescence (see Trautz and Schorigin, *loc. cit.*). Of 285 inorganic substances examined by the author or earlier workers, 33 are found to be triboluminescent; of 147 aliphatic compounds 30, of 305 aromatic compounds 112, are found to be triboluminescent; of 90 alkaloids and alkaloid derivatives, as many as 63 are triboluminescent. There are certainly some cases at least of triboluminescent substances which do not exhibit physical isomerism of any sort. A large number of reactions was examined for reaction luminescence, and this phenomenon was observed specially in cases where oxygen or the halogens were the active agents. It was found that increase of the reaction velocity, and whatever contributed to this, increased the intensity of the luminescence. The spectrum of the light emitted in cases of crystalloluminescence and reaction luminescence is continuous even with luminescent gases, as, for example, in the cold (50—90°) acetylene-chlorine and acetylene-bromine flames. J. C. P.

**Atmospheric Electricity [Radioactivity] in High Latitudes.** GEORGE C. SIMPSON (*Phil. Trans.*, 1905, A, 205, 61—97).—This paper records results of observations made in Lapland, and part of it deals with the influence of the wind, the humidity, the height of the barometer, &c., on the atmospheric radioactivity. The observations give strong support to Elster and Geitel's view that the emanation in the air originates from the radium or radioactive emanation in the soil. Anything which tends to reduce the atmospheric circulation tends also to increase the quantity of emanation in the lower layers of the atmosphere. J. C. P.

**Radioactivity of Atmospheric Precipitations and of Surface Waters.** JOSEF JAUFMANN (*Chem. Centr.*, 1905, ii, 600; from *Metereol. Zeit.*, 22, 102—113).—A measured amount of potassium alum solution is added to 1 litre of the water under examination and precipitated with ammonia. The radioactivity of the emanation and the induced radioactivity, which are all collected in the precipitate, are determined together in an apparatus resembling that of Elster and Geitel, and are found generally to lie between the activity of radium and that of thorium. Rain is always slightly active, most so that collected during a thunderstorm in the spring, or in a town; the activity diminishes as the rain shower continues; freshly fallen snow is 3—5



times as active; rain and snow diminish in activity after they have fallen, but snow on the ground may be reinforced by further absorption. The radioactivity of hailstones is greater than that of rain. Natural ice also is sometimes strongly radioactive.

Surface water is always radioactive, but the values vary enormously and seem to depend on the atmospheric pressure. This applies also to spring waters; the deepest spring is most radioactive. If the ground is frozen for long, the radioactivity increases, and diminishes again after a thaw.

G. Y.

**Production of Radium from Uranium.** BERTRAM B. BOLTWOOD (*Amer. J. Sci.*, 1905, [iv], 20, 239—244. Compare Abstr., 1904, ii, 666).—The author considers that the conclusions drawn by Soddy from his experiments on the production of radium are unjustifiable. With a view to determining whether it is possible to observe the formation of radium in a uranium solution, 250 c.c. of a solution containing 100 grams of "purest uranium nitrate," which had been recrystallised five times, were introduced into a glass bulb of 400 c.c. capacity, the neck of which was then drawn out and sealed. Thirty days later, the entire gaseous contents were removed and transferred to an electroscope, and in order to displace the dissolved gases and any radium emanation the solution was boiled for fifteen minutes. The electroscope was capable of detecting  $1.7 \times 10^{-11}$  gram of radium, but no increase in the normal leak of the instrument could be detected. Similar negative results were obtained at the end of six months and of 390 days. It can be positively asserted that in 390 days the quantity of radium produced from 48 grams of uranium in a uranium nitrate solution is less than  $1.7 \times 10^{-11}$  gram. This is less than one-sixteen-hundredth of the quantity which would be expected from the disintegration theory if the value of  $\lambda$  for radium is taken as  $8.8 \times 10^{-4}(\text{year})^{-1}$ . The experiments indicate that one or more products of a slow rate of change intervene between uranium and radium.

H. M. D.

**Properties of Radium in Small Quantities.** A. VOLLER (*Chem. Centr.*, 1905, ii, 388; from *Physikal. Zeit.*, 1905, 6, 409—411).—A reply to Eve (this vol., ii, 367).—The author has repeated his experiments with some modifications and again finds the intensity of radiation is not proportional to the quantity of radium; if the latter is reduced to one-millionth of its original amount, the fall of potential produced by it is only reduced to one-three-hundredth. The same amount of radium spread over ten times the area produces 4 or 5 times as great a fall of potential as before. The suggestion is put forward that the breakdown of radium bromide can be retarded by the presence in the surrounding air of the products of decomposition. Rutherford's suggestion (this vol., ii, 367) that solid radium bromide volatilises is not regarded as probable, inasmuch as an active plate hardly ever loses its activity. The author maintains that radium compounds decompose more rapidly at the surface than at lower layers.

P. H.

**Scintillations produced by Radium.** ROBERT W. WOOD (*Phil. Mag.*, 1905, [vi], 10, 427—430).—Different interpretations have been given of the scintillations at a zinc sulphide screen caused by the bombardment of radium corpuscles. According to Crookes, each flash is due to the impact of a positive  $\alpha$ -particle; according to Becquerel, the production of light results from cleavage of the crystals, brought about by the action of the rays. The author has determined the duration of (1) the spinthariscopes flashes, (2) the flashes produced by cleavage, that is, the triboluminescence. It appears that the duration of (1) is between 1/15,000th and 1/20,000th of a second, much shorter than that of (2). Hence it is probable that the two phenomena are not very closely related. A photographic examination of the scintillations shows that only a small percentage of zinc sulphide crystals becomes luminous under the radium rays. It is known that the phosphorescent power of most substances is due to minute traces of impurity, and hence a scintillation probably occurs only when an electron strikes a molecule of the impurity. This would do away with the difficulty involved in Crookes' view, for the actual number of  $\alpha$ -particles emitted from the radium must far surpass the number of flashes of light as seen in the spinthariscopes. J. C. P.

**Slow Transformation Products of Radium.** ERNEST RUTHERFORD (*Phil. Mag.*, 1905, [vi], 10, 290—306. Compare Abstr., 1904, ii, 799).—Further experiments on the variation of activity of the successive products of radium have been made, and a new product, previously overlooked, has been isolated.

At the end of twenty-four hours the products, radium-A, -B, and -C, which are formed on a plate exposed to radium emanation, have been almost completely transformed, but there is a small residual activity comprising both  $\alpha$ - and  $\beta$ -rays which is in general of the order of one-millionth of the activity immediately after removal.

The  $\beta$ -ray activity increases with time according to the equation  $I = I_0(1 - e^{-\lambda t})$ , and reaches a practical maximum after about forty days. Half the final activity is attained in six days and the constant  $\lambda = 0.115(\text{day})^{-1}$ . The  $\alpha$ -ray activity also increases and reaches half its final value in about 143 days.

The explanation of the experimental results is that the primary product, radium-D, does not emit either  $\alpha$ - or  $\beta$ -rays; it undergoes slow transformation (half complete in forty years) with the formation of a product, radium-E, which emits  $\beta$ - and probably  $\gamma$ -rays, and this  $\beta$ -ray product is the parent substance of a product, radium-F (previously termed radium-E), which emits only  $\alpha$ -rays.

By heating a platinum plate coated with the active deposit at 1000°, radium-F and the greater part of radium-D are volatilised. The activity of the residual radium-E decreases exponentially with the time and reaches half value in 4.5 days. The difference between the transformation periods deduced from the recovery curve and the decay curve is attributed to an alteration in the radium-E after exposure to the high temperature.

When a bismuth plate is introduced into solution of the active

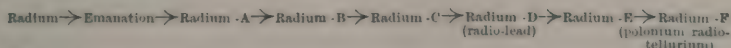
deposit, radium-F is deposited and separated from radium-D and -E. The activity of the deposit decays exponentially and reaches half value in 143 days [ $\lambda = 1.77(\text{year})^{-1}$ ].

From the agreement in the chemical and physical properties of radium-F and radiotellurium and the equality of their decay constants, there can be little doubt about the identity of these two substances. It is calculated that a ton of mineral containing 50 per cent. of uranium contains 0.14 mg. of radium-F, and this number agrees closely with the amount of radiotellurium extracted by Marckwald from uranium residues. Assuming that the  $\alpha$ -particles from radium and radium-F produce about the same amount of ionisation, the activity of radium-F in the free state should be about 3200 times the activity of pure radium at its minimum activity, which also agrees with Marckwald's observations on the activity of radiotellurium.

The published observations on polonium indicate the presence of impurities, but there can be little doubt that the chief constituent of polonium is identical with radium-F.

Some experiments with a sample of radio-lead, four months old, showed that the  $\beta$ -ray activity was constant during six months, whilst the  $\alpha$ -ray activity steadily increased. These, and the observations of Hofmann, Gonder, and Wölfl (this vol., ii, 71) on radio-lead, seem to indicate that old radio-lead consists of radium-D, -E, and -F, whilst a freshly prepared specimen is probably represented by radium-D.

The entire process of disintegration of radium according to present data corresponds to the following scheme :



Time for half transformation :

1300 years 4 days    3 mins.    21 mins.    28 mins.    40 years    6 days    143 days

Ray emission :

$\alpha$              $\alpha$              $\alpha$             —             $\alpha, \beta, \gamma$     —             $\beta, \gamma$              $\alpha$

No evidence of further transformation has been obtained. If the  $\alpha$ -particle is a helium atom, then, since five products emitting  $\alpha$ -particles are present in radium, the atomic weight of the transformation product should be  $225 - 20 = 205$ . This number is very nearly equal to the atomic weight of lead, and the view that lead is the end-product of the series is supported by the fact that lead is always present in the radioactive minerals in about the amount to be theoretically expected from the content of uranium when the quantity of helium present is used to compute the age of the minerals. H. M. D.

**Some Properties of the  $\alpha$ -Rays of Radium.** HENRI BECQUEREL (*Compt. rend.*, 1905, 141, 485—490).—A reply to Bragg and Kleeman and to Rutherford (compare Becquerel, *Abstr.*, 1903, ii, 256, 257, 402, 523; 1904, ii, 6; Bragg and Kleeman, this vol., ii, 5; Rutherford, this vol., ii, 495). M. A. W.

**Decomposition of Water by Radium.** SIR WILLIAM RAMSAY (*Meddel. k. Vet. Akad. Nobelinst.*, 1905, 1, 909—911).—It has been



found by various observers that the gas evolved by decomposition of water by means of radium bromide contains an excess of hydrogen. Various causes are suggested to which this might be due, one of which, namely, oxidation of grease of stopcocks, &c., is of frequent occurrence. When this is avoided, it is found that neither free bromine nor ozone is produced, that it does not seem probable that hydrogen is evolved from radium itself, and that no hydrogen peroxide or radium bromate is formed. In the presence of the emanation, however, dry oxygen is found to oxidise the mercury, and when the emanation acts on pure water with no oxidisable substance present, the gases produced consist wholly of the explosive mixture of oxygen and hydrogen. The action must be attributed wholly to  $\alpha$ -rays, as  $\beta$ -rays are without action. L. M. J.

**Absorption of the  $\beta$ - and  $\gamma$ -Rays of Actinium.** T. GODLEWSKI (*Phil. Mag.*, 1905, [vi], 10, 375—379. Compare this vol., ii, 497, 498).—The penetrating power of the  $\beta$ -rays of thorium and radium increases with the thickness of matter traversed, whereas the  $\beta$ -rays of actinium are homogeneous, and absorption takes place according to the exponential equation  $I = I_0 e^{-\lambda x}$ , where  $x$  is the thickness of matter traversed.

The penetrating power of the  $\beta$ -rays of actinium is only about 40 per cent. of that of the uranium rays, and about one-third of the average penetrating power of the  $\beta$ -rays of radium.

Experiments with different metals show that the deviations from the absorption density law ( $\lambda/d = \text{constant}$ ) are considerably smaller than in the case of the other radioactive elements. The thickness of metal required to absorb half the rays and the absorption constant has been determined.

	Aluminium.	Mica.	Brass.	Copper.	Tinfoil.	Lead.
Thickness (mm.).....	0.212	0.21	0.065	0.063	0.045	0.0425
$\lambda$ cm. <sup>-1</sup> .....	32.7	33.0	108.0	139.0	154.0	163.0
$\lambda/d$ .....	12.9	12.0	13.1	15.9	15.7	14.1

The absorption of the  $\gamma$ -rays of actinium follows an exponential law. These rays also have a very small penetrating power compared with the  $\gamma$ -rays of other radioactive elements, for example, only about one-tenth of that of the more penetrating  $\gamma$ -rays of radium. For iron, zinc, and lead, the thickness of metal required to absorb half the rays is 5.70, 5.60, and 1.92 mm., and the absorption constants 1.23, 1.24, and 4.54 respectively. H. M. D.

**Determination of Wave-lengths in the Spectrum of Giesel's Emanium.** J. HARTMANN (*Chem. Centr.*, 1905, ii, 388; from *Physikal. Zeit.*, 1905, 6, 401—402).—In addition to the line previously described at  $488.5\mu\mu$ , the spectrum comprises the following: two bands, one brighter at  $356\mu\mu$ , the other weaker at  $434\mu\mu$ ; two very faint, fine lines,  $413.7\mu\mu$  and  $474.3\mu\mu$  respectively; an indistinct double line ( $527.2\mu\mu$  and  $530.6\mu\mu$  ?), and two very faint lines,  $570.4\mu\mu$  and  $583.8\mu\mu$ . Traces of impurity, such as a mechanically retained gas or a solid substance in solid solution, might conceivably

become luminous through the radiation of the emanation, as is the case, described by Giesel, of the addition of didymium to lanthanum chloride. It has, however, not yet been proved whether the spectrum just mentioned is identical with that of didymium or not. It is noteworthy that a substance which is luminous at low temperatures without external supply of energy should give a spectrum with well-defined lines, and having a maximum in the ultra-violet region.

P. H.

**Generator Gas- and Carbon-cells.** FRITZ HABER and ALEXANDER MOSER (*Zeit. Elektrochem.*, 1905, 11, 593, 609).—The lower end of a test-tube is etched inside and outside with hydrofluoric acid, the roughened surfaces moistened with platinic chloride and heated so as to produce a coating of spongy platinum; electrical contact is made to the coatings by means of platinum wires, and suitable tubes are introduced to allow of carbon monoxide, oxygen, or other gases being brought into contact with the platinum coatings. The whole is heated by a jacket of boiling sulphur on phosphorus pentasulphide. The hot glass itself acts as the electrolyte, the two coatings of platinum being the electrodes. In most of the experiments the outer coating was in contact with air, a mixture of carbon dioxide with a little carbon monoxide or pure oxygen being passed into the inside of the tube and the difference of potential between the electrodes measured. A discussion of the thermodynamics of the reaction  $\text{CO} + \frac{1}{2}\text{O}_2 = \text{CO}_2$  leads to the following expression for the free energy  $A$ :

$A = 67440 - 2.42T \log T + 0.0017T^2 - 4.56T \log_{10} p_{\text{CO}_2}/p_{\text{CO}} \times p_{\text{O}_2}^{1/2} - 5.95T$ .  
From this the *E.M.F.*'s at the absolute temperatures 717° and 791° are easily calculated by substituting the values of  $T$  and dividing by 46220. The partial pressures of the reacting gases are used in place of their concentrations. The differences of potential measured are well defined and easily reproduced. At the temperature of boiling phosphorus pentasulphide, a mixture of 96.1 per cent.  $\text{CO}_2$  and 1.6 per cent.  $\text{CO}$ , measured against oxygen, gave 0.944 to 0.975 volt, the calculated value being 0.964 volt. In sulphur vapour, a mixture of 97.8 per cent.  $\text{CO}_2$  and 1.71 per cent.  $\text{CO}$  gave 1.012 volts, the calculated value being 1.013 volts. It is also shown that variations in the concentration of the carbon monoxide or of the oxygen produce changes in the *E.M.F.* which agree in sign and very nearly in magnitude with those required by the theory. When pure carbon monoxide is used, it decomposes in presence of the platinum, depositing carbon. This deposit of carbon produces an *E.M.F.* (of nearly 1 volt). That the *E.M.F.* is due to the carbon is proved by the fact that it persists in presence of carbon dioxide, but disappears if oxygen is passed in. In conclusion, an experiment was made with hydrogen and oxygen in the same apparatus. The *E.M.F.* measured varied from 1.183 to 1.196 volt, the calculated value being 1.153 volt.

The resistance of a carbon monoxide-oxygen cell, constructed in the way described, is about 500 ohms; when closed through an external resistance of 10,000 ohms, a current is produced which at first rapidly diminishes; after a minute it reached the value  $0.32 \times 10^{-4}$  ampere: the *E.M.F.* of the cell had fallen to 0.26 volt.

T. E.

**Mean Potential at Electrodes under the Action of Alternating Currents.** PHILIP GEORGE GUNDRY (*Zeit. physikal. Chem.*, 1905, 53, 177—212).—A theoretical and physical paper. The author has made experiments in which an alternating current of varying frequency was sent through an electrolyte between two mercury electrodes, the one very small, and the other so large that it could be regarded as unpolarisable in comparison with the smaller. The effects observed were (1) an alteration of the direct current or of the *E.M.F.*, (2) an alteration of the surface tension of the mercury. The first effect may be due to (a) the asymmetry of the polarisation, or (b) the partial transport of the cathodic component of the current by hydrogen. When a typical salt is taken as the electrolyte, (a) is masked by (b). With complex salts, especially those giving an alkaline reaction, (b) is negligible, and the result of (a) is evident. J. C. P.

**Chemical Transfer of Metallic Potentials.** ROBERT LUTHER (*Zeit. physikal. Chem.*, 1905, 52, 626—628).—Critical remarks on Fischer's recent paper (this vol., ii, 501). The author points out that several years ago he made experiments similar to some of Fischer's (see Abstr., 1901, ii, 301). J. C. P.

**Temperature-coefficient of Electrical Resistivity of Carbon at Low Temperatures.** H. MORRIS-AIREY and E. D. SPENCER (*Mem. Manchester Phil. Soc.*, 1905, 49, [x], 1—8).—The measurements were made with carbon filaments taken from Ediswan incandescent lamps. The filament, together with a platinum resistance thermometer, was suspended centrally in a thick brass cylinder surrounded by a Dewar tube. After initial determination of the resistance with the filament and thermometer immersed in liquid air, this was poured out and a series of measurements was made during the steady rise of temperature, which was comparatively slow on account of the considerable heat capacity. The resistance of the carbon increases uniformly as the temperature falls until  $-150^{\circ}$  is reached, when the rate of increase over a small interval of temperature is smaller; at  $-182^{\circ}$ , however, the resistance has increased to a value which corresponds almost exactly with that calculated by extrapolation by means of the constant temperature-coefficient. A readjustment of the relative positions of the particles is suggested as the cause of the observed irregularity. A table of specific resistances between  $-197^{\circ}$  and  $-4^{\circ}$  is appended. H. M. D.

**Disruptive Discharge in Gases at High Pressures.** CH. EUG. GUYE and H. GUYE (*Arch. Sci. phys. nat.*, 1905, 20, 111—123).—The potential difference necessary to produce the disruptive discharge for a definite distance was determined for various gases at different pressures. It was found that between 1 and 10 atmospheres the potential is a linear function of the pressure; at higher pressures, the ratio of potential to pressure diminishes. In the case of nitrogen, the curve



exhibits a maximum in the neighbourhood of the pressure of maximum compressibility. The experiments with air similarly showed a slight rise in the curve for  $p=65$  metres of mercury. Experiments with carbon dioxide in the neighbourhood of the critical point indicated a lowering of the explosion potential, but the experiments are complicated by the partial decomposition of the gas. Little or no effect was found to result from the presence of salts of radium or the influence of X-rays.

L. M. J.

**Glow Discharge in Vapours of the Mercuric Haloids.** W. MATTHIES (*Ann. Physik*, 1905, [iv], 17, 675—693).—Work on the potential gradient in gases at low pressure has been largely confined to nitrogen; the author has extended investigations of this nature to the vapours of mercuric chloride, bromide, and iodide. He finds that the glow discharge in these gases does not differ from that in the elementary gases, and verifies the absence of any noticeable decomposition with suitable current and platinum electrodes. Copper, iron, aluminium, and mercury cause decomposition without current. The potential gradients are considerably higher than that for nitrogen, as are also the cathode and anode falls. The gradient increases with pressure at first more rapidly, later more slowly than the latter. The dependence on current strength appears very complicated, differing for different pressures; the gradient also decreases with increasing cross-section of the tube. The cathode fall increases approximately as the molecular weight of the compound.

L. M. J.

**Conductivity of Sulphuric Acid at Different Temperatures.** BLAS CABRERA FELIPE (*Chem. Centr.*, 1905, ii, 438—439; from *Physikal. Zeit.*, 1905, 6, 422—429).—The composition of the solutions, which vary from 2.66 to 35.34 mols. of water per mol. of sulphuric acid, was determined by measurement of their densities at 15°. The conductivity temperature curve is convex towards the temperature axis at high concentrations and concave at low concentrations. With increasing dilution, the point of inflection is displaced more and more towards the lower temperatures. The existence of these points is explained by the antagonistic influence of the temperature on the mobility and on the degree of dissociation. If the conductivity at each temperature be expressed as a function of the concentration, the conductivity maxima appear most sharply defined at high temperatures. Occasionally two maxima are observed, but the author is not convinced of the existence between these of a minimum corresponding with 14 mols. of water per mol. of acid.

P. H.

**Electrical Conductivity of Potassium and Sodium Nitrates and of Fused Mixtures of the Two Nitrates together and with other Salts.** ALEXIS BOGORODSKY (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 760—807).—The author has determined the specific electrical conductivities of fused potassium and sodium nitrates and various mixtures of the two salts at different temperatures, the results being given in reciprocal ohms in the following table:

Temperature.	Per cent. by weight of potassium nitrate.						
	100.	94.392.	73.224.	54.323.	49.386.	14.493.	0.
348°	0.639	0.662	0.751	0.830	0.848	1.045	1.122
351	0.649	0.671	0.760	0.843	0.857	1.048	1.137
354	0.658	0.680	0.770	0.854	0.866	1.055	1.152
357	0.667	0.689	0.779	0.865	0.877	1.067	1.166
360	0.676	0.699	0.787	0.875	0.888	1.088	1.179
363	0.685	0.709	0.796	0.885	0.901	—	1.192

The conductivities of these mixtures are smaller throughout than the numbers calculated additively.

The author has also examined the effect on the specific conductivity of fused sodium nitrate of admixtures of a number of other salts in varying proportions. Lithium chloride causes a slight increase in the conductivity of sodium nitrate, but all the other salts experimented with diminish the conductivity. The results are given in detail.

T. H. P.

**Use of Balanced Electrodes.** W. W. HALDANE GEE (*Trans. Faraday Soc.*, 1905, 1, 237—250).—Several forms of balance voltmeters are described for measuring quantities of electricity with a degree of accuracy sufficient for commercial purposes. In one of these, the cathode is suspended in a solution of a salt of the metal to be deposited from one of the pans of an ordinary physical balance. Before starting, the cathode is accurately counterpoised; the current is then passed, and the increase in weight of the cathode is determined. With copper, zinc, silver, and mercury, satisfactory results were obtained. In a second form of apparatus, a hydrometer constructed of thin brass is employed as a combined cathode and balance, and in a third a spring balance arrangement from which the cathode is suspended gives a convenient means of measuring total current flow.

H. M. D.

**Very Unequal Electrodes. Valve Cells. Metal Vegetation.** W. HOLTZ (*Chem. Centr.*, 1905, ii, 595; from *Physikal. Zeit.*, 6, 480—485).—Currents of varying *E.M.F.* are passed through an electrolytic cell containing an acid or salt solution and two electrodes of the same metal, but of very different sizes. If the direction of the current is changed, the deflection of the galvanometer is almost always altered; with some metals, the deflection is smaller when the small electrode is the anode, but reversely with other metals. The variation in the deflection is greater usually when the concentration of the solution and the *E.M.F.* are smaller. Valve cells, which approach the aluminium cell, are formed with iron, lead, nickel, antimony, and bismuth in 1 per cent. sulphuric acid when the *E.M.F.* is small, but with copper in copper sulphate or chloride when the *E.M.F.* is moderate. Metal trees are formed by copper, zinc, iron, cadmium, and cobalt in addition to

the cases previously known; the branching is most delicate with cadmium, and is fungus-like with cobalt. The cause of the irregularities lies in the smaller electrode on which is formed a layer of oxide or superoxide if it is the anode, or of hydrogen or loose metallic deposit if it is the cathode. G. Y.

**The Behaviour of Magnesium Anodes.** G. BABOROVSKÝ (*Zeit. Elektrochem.*, 1905, 11, 465—482).—Hydrogen is evolved at a magnesium anode immersed in a neutral solution of a sulphate or chloride and a black substance is formed, which was formerly regarded as a suboxide, but which appears to be a mixture of hydroxide and finely-divided magnesium produced by the pulverisation of the anode. The anode has an apparent valency of about 1.3 which is almost independent of the experimental conditions. A very considerable transition resistance is found at the surface of the anode. By means of a special method the potential of the anode was measured, notwithstanding this resistance, and found to be approximately the same as that of the metal when no current is passing. The latter quantity is very badly defined; referred to Ostwald's zero it is about 1.7 volts.

Attempts to prepare a magnesium suboxide were unsuccessful; the black powder formed at the anode could not be separated from magnesium hydroxide. Magnesium amalgam, when exposed to moist air, rapidly oxidises to a brown, earthy mass from which metallic mercury may be separated by distillation in a vacuum. The residue contains oxides of mercury and magnesium. When a rod of magnesium is immersed in water in contact with copper or platinum, a grey powder is produced which can be partially separated from magnesium hydroxide by suspension in water, but this substance also appears to consist of a mixture of finely-divided metal and hydroxide.

In alkaline solutions, the behaviour of magnesium resembles that of aluminium. An applied *E.M.F.* of 110 volts produces a very small current at first; after some time the temperature rises and a larger current begins to pass; in both cases the magnesium is scarcely acted on and oxygen mixed with about 3 per cent. of hydrogen is evolved. Similar phenomena are observed with lower applied *E.M.F.*'s, but with 2 volts the second stage cannot be observed. During the second stage, the metal dissolves with an apparent valency of about 9. The phenomena may be explained by supposing that a non-conducting layer of hydroxide first forms on the anode; owing to electric endosmosis, this soon dries up, shrinks, and cracks. It is well known that a non-conductor containing fine cracks or pores possesses metallic conductivity. This explains the change from the first to the second stage; the attack of the metal during the second stage is due to portions of the oxide layer falling off and exposing a fresh metallic surface.

In a solution containing both potassium chloride and hydroxide, oxygen and hydrogen are evolved simultaneously at a magnesium anode, and in consequence some anomalous reactions may be observed. In neutral solutions, for example, potassium permanganate and potassium chromate are reduced, whilst iodine is set free from potassium iodide; in alkaline solutions, bromine and iodine ions are oxidised to



$\text{BrO}_3$  and  $\text{IO}_3$  ions, permanganate is probably reduced to manganate, whilst chlorine ions are unaltered. T. E.

**Cathodic Pulverisation of Tellurium.** ERICH MÜLLER and RICHARD LUCAS (*Zeit. Elektrochem.*, 1905, 11, 521—525).—With an applied *E.M.F.* of 4 volts or more, in pure water, a tellurium cathode loses weight, and yields a colloidal solution of tellurium. The very dilute solutions are reddish-violet in colour, the more concentrated solutions are brown and opaque. The tellurium goes into solution with an apparent valency of about 1.2, which indicates that the pulverisation is not merely mechanical. The dissolution is independent of the presence of oxygen in solution and is therefore not due to oxidation of tellurium hydride. No hydrogen is evolved at the tellurium cathode. The phenomena are analogous to those observed with copper anodes (Abstr., 1903, ii, 587), and may be explained by assuming that the tellurium goes into solution in the form of the ion  $\text{Te}'$ , which then passes into bivalent tellurium ions either by direct assumption of a second charge from the electrode or by the reaction  $2\text{Te}' = \text{Te} + \text{Te}''$ .

In alkaline solutions, the pulverisation takes place also, but alkali polytellurides are also formed. In acid solutions, hydrogen is evolved and only a trace of pulverisation can be observed, the discharge potential of hydrogen in the acid solution being lower than that required for the dissolution of tellurium. T. E.

**Electrolysis with Alternating Currents.** ANDRÉ BROCHET and JOSEPH PETIT (*Ann. Chim. Phys.*, 1905, [viii], 5, 307—345. Compare Abstr., 1904, ii, 229, 230; this vol., ii, 7, 27, 28, 227).—The secondary reactions which take place when platinum dissolves in a solution of barium cyanide under the influence of an alternating current (Abstr., 1904, ii, 229, 414) may be represented by the equations: (1)  $\text{Ba}(\text{CN})_2 + 10\text{H}_2\text{O} = \text{Ba}(\text{NO}_3)_2 + 2\text{CO}_2 + 10\text{H}_2$ ; (2)  $\text{Ba}(\text{CN})_2 + 5\text{H}_2\text{O} = \text{BaCO}_3 + \text{CO}_2 + 2\text{NH}_3 + 2\text{H}_2$ , and (3)  $\text{Ba}(\text{CN})_2 + 2\text{H}_2\text{O} = \text{Ba}(\text{CNO})_2 + 2\text{H}_2$ . The third of these reactions may be an intermediate stage in the first.

When iron dissolves in a solution of potassium cyanide under the influence of an alternating current, the cyanide is transformed almost quantitatively into potassium ferrocyanide, but only about 40 per cent. of the hydrogen required by the equation  $\text{Fe} + 6\text{KCN} + 2\text{H}_2\text{O} = \text{K}_4\text{Fe}(\text{CN})_6 + 2\text{KOH} + \text{H}_2$  is evolved. This deficiency of hydrogen appears to indicate that the metal dissolves at the anode.

When a solution of sulphuric acid is electrolysed, using platinum electrodes and a combination of alternating and continuous currents (compare Ruer, Abstr., 1903, ii, 407), the platinum slowly dissolves. This appears to be the result of the variation in current density and not to any specific action of the alternating current, since a sinuoidal alternating current obtained from an electrolytic valve of special design produces qualitatively the same effect as a combination of alternating and continuous currents. The platinum also dissolves under the influence of an alternating current in presence of oxidising agents such as nitric acid, chromic acid, &c.

The alternating current appears to exert a specific action in the case

of lead electrodes in dilute sulphuric acid. The metal dissolves and a deposit of lead sulphate, comparatively pure when a current of high density is used and containing reduced lead when a low density current is employed, is formed. The amount of hydrogen evolved varies with the current density and the temperature. With chromic acid in place of sulphuric acid as an electrolyte, reduction occurs and ozonised oxygen is evolved. Phosphoric and arsenic acids behave in much the same way as sulphuric acid, but with them temperature has no influence on the action. The solution of the lead appears to be due to the formation of lead peroxide at the anode, which on the reversal of the current is reduced first to lead sulphate and finally to lead. The reduction of lead sulphate is, however, difficult, especially in the cold, and consequently the sulphate accumulates and the electrode continues to dissolve.

The authors' results show that the alternating current is applicable to many types of reactions, as in the oxidation of ferrous and manganous salts, the reduction of nitric and chromic acids and similar highly oxygenated substances, and to the electrolysis of the hydric acids and their salts. Sulphuric acid, sulphates, chlorates, perchlorates, and chromates appear to be stable towards the alternating current.

The only possible practical application of these results yet observed is the preparation of barium platinocyanide (Abstr., 1904, ii, 414). The memoir concludes with a general discussion and *résumé* of the whole of the results obtained.

T. A. H.

**Electrolysis with Alternating Currents.** ANDRÉ BROCHET and JOSEPH PETIT (*Zeit. Elektrochem.*, 1905, 11, 441—453. Compare this vol., ii, 27, 28, 227, and 261).—When a current of variable strength (produced by passing an alternating current through an aluminium electrolytic rectifier) is passed through sulphuric acid between platinum electrodes, the anode goes into solution as platinum sulphate, whilst platinum is deposited at the cathode; the deposition at the cathode is prevented or diminished by the presence of oxidising agents such as chromic acid or persulphuric acid; the solution at the cathode is facilitated by small quantities, but diminished by large quantities. The effect of an alternating current is easily understood by means of these results when it is considered that the same electrode is, in this case, alternately anode and cathode. The superposition of a continuous current on an alternating current is shown to be equivalent to the use of a rectified alternating current.

T. E.

**Alternate Current Electrolysis.** ERNEST WILSON (*Trans. Faraday Soc.*, 1905, 1, 305—312).—Experiments are described in which the effect of an alternating current on plates of lead, zinc, iron, copper, tin, and aluminium immersed in various electrolytes has been investigated. The duration of the action, the frequency of alternation, the current density, and the alteration in weight of the plates are recorded, and curves are appended which show the relationship between the current, the difference of potential between the plates, and the difference of potential between one plate and the electrolyte during

the period of an alternation. For details, the original must be consulted.  
H. M. D.

**Oxidation and Reduction in the Electrolysis of Solutions of Salts of Iron.** Z. KARAOGLANOFF (*Zeit. Elektrochem.*, 1905, 11, 489—496).—The current which just produces an evolution of hydrogen at a platinum cathode immersed in a solution of iron alum in two minutes was found to be proportional to the concentration of the solution; it increases by about 3 per cent. of its value per degree rise of temperature. The addition of some normal salts to the solution increases the value of the critical currents; in the case of copper sulphate, for example, this is due to the deposition of copper at the cathode; other salts have no action and a few diminish the critical currents; among these, the action of the chromates is probably due to the formation of a diaphragm of chromic oxide. With smooth platinum, the critical current is proportional to the surface of the electrode, hence with platinised electrodes very much larger currents can be used. A horizontal cathode gives a larger value than a vertical one. Stirring the solution has a very marked effect in increasing the critical current. A coulometer is constructed on the basis of these results; the anode is enclosed in a porous pot near the surface of the solution of iron alum in which the platinised cathode is immersed and which is stirred by a current of carbon dioxide. The ferrous salt produced is titrated with a solution of potassium permanganate. The mean error of a measurement is +0.23 coulomb.  
T. E.

**Theory of the Residual Current.** WALTHER NERNST and E. S. MERRIAM (*Zeit. physikal. Chem.*, 1905, 53, 235—244).—A rapid and trustworthy determination of the residual current for small *E.M.F.*'s is made possible by the use of a small electrode rotating at a high speed. In those cases where the rate of action of the depolariser is high compared with the velocity of diffusion, the residual current reduces itself to a case of diffusion, and as such may be calculated on the basis of Nernst's theory (see Salomon, *Abstr.*, 1898, ii, 7). The agreement between the calculated and observed values of the residual current is good, and this circumstance is evidence in support of Nernst and Brunner's theory of the velocity of reaction in heterogeneous systems (*Abstr.*, 1904, ii, 315). Where the depolariser acts slowly, the observed values of the residual current are lower than the calculated values, and in these cases the influence of the rate of rotation of the electrode becomes very small. By the method indicated above, it is possible to investigate the residual current for acid-alkali polarisation, and so to arrive at an accurate determination of the neutralisation point.  
J. C. P.

**Specific Heat of Iron at High Temperatures.** JOHN A. HARKER (*Phil. Mag.*, 1905, [vi], 10, 430—438).—The mean specific heat *S* for the temperature range 0°—*T*° C. is given in the following table:



<i>T.</i>	<i>S.</i>	<i>T.</i>	<i>S.</i>
200°	0·1175	700°	0·1487
250	0·1204	750	0·1537
300	0·1233	800	0·1597
350	0·1257	850	0·1647
400	0·1282	900	0·1644
450	0·1311	950	0·1612
500	0·1338	1000	0·1557
550	0·1361	1050	0·1512
600	0·1396	1100	0·1534
650	0·1440		

The author considers that the diminution at 900° and the subsequent rise in the specific heat require confirmation. J. C. P.

**Molecular Rise of the Lower Critical Temperature of a Binary Mixture of Normal Components.** JOHANNES J. VAN LAAR (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 144—152).—The earlier theoretical work (this vol., ii, 434) is revised, and it is found unnecessary to double the molecular formula of sulphur dioxide or of carbon dioxide. An approximate expression for the molecular rise of the lower critical temperature is  $1/T_1 \cdot (dT_x/dx)_0 = \theta(\theta - 1)$ , where  $\theta$  is the ratio  $T_2/T_1$  of the two critical temperatures. J. C. P.

**Liquid Mixtures of Minimum Boiling Point.** CLIFFORD D. HOLLEY and J. T. WEAVER (*J. Amer. Chem. Soc.*, 1905, 27, 1049—1057. Compare Abstr., 1902, ii, 443).—A number of mixtures of liquids have been investigated by the boiling-point method and the following minima have been found: 10 parts of propyl alcohol (b. p. 95·6°) and 90 parts of propyl bromide (b. p. 71·5°) give a liquid with b. p. 69·75°. 16·24 parts of ethyl alcohol (78·4°) and 83·76 parts of propyl bromide give a liquid with b. p. 63·6°. 20·60 parts of methyl alcohol (64·0°) and 79·40 parts of propyl bromide give a liquid with b. p. 54·8°. 19·25 parts of propyl alcohol and 80·75 parts of isobutyl bromide (89·2°) give a liquid with b. p. 86·1°. 41·0 parts of ethyl alcohol and 59·0 parts of isobutyl bromide give a liquid with b. p. 71·4°. With methyl alcohol and isobutyl bromide, a minimum boiling point is obtained at 60°, but this point is not definite, as the mixture may contain from 41 to 56 per cent. of the bromide without any change in the boiling point. 72·0 parts of ethyl alcohol (78·3°) and 28·0 parts of amyl bromide (118·2°) give a liquid with b. p. 77·3°. The addition of as much as 10 per cent. of amyl bromide produces no change in the boiling point of methyl alcohol (64·0°), and further additions cause slight elevations of the boiling point of the mixture. Eight parts of methyl alcohol (64·8°) and 92 parts of methyl iodide (44·5°) give a liquid with b. p. 39·6°. 87·5 parts of bromoform (145·5°) and 12·5 parts of butyric acid (158—159°) give a liquid with b. p. 142·6°. 11·80 parts of propyl alcohol (95·5°) and 88·20 parts of carbon tetrachloride (76·70°) give a liquid with b. p. 72·6°.

Mixtures of carbon tetrachloride with benzene or toluene do not present any unusual phenomena.

The following mixtures show no minimum boiling point: propyl bromide with amyl alcohol or isobutyl alcohol; isobutyl alcohol with isobutylbromide, isobutyl acetate, ethyl butyrate, or amyl acetate; isobutyl bromide with bromoform, amyl acetate, or ethylene bromide; ethylene bromide with bromobenzene or bromoform.

The results of this investigation show that the constitution of the substances has a greater influence on the formation of mixtures with minimum boiling points than the close proximity of their boiling points.

E. G.

**Modification of Victor Meyer's Apparatus for the Determination of Vapour Densities.** BERNARD J. HARRINGTON (*Amer. J. Sci.*, 1905, [iv], 20, 225—228).—Two modified forms of apparatus are described. In the first, the cylindrical bulb in which vaporisation of the substance takes place is horizontal instead of vertical, and the long stem is bent upon itself a number of times. The second form is similar, but the bulb is in this case vertical. Both forms are very compact, and can be heated in an enclosed box of copper or tinned iron; the construction is, moreover, such that the vapour can be very quickly swept out of the apparatus. Experience has shown that good results can be obtained much more rapidly than with the ordinary form of apparatus.

H. M. D.

**Determination of Molecular Weights in Boiling Concentrated Sulphuric Acid.** ERNST BECKMANN (*Zeit. physikal. Chem.*, 1905, 53, 129—136).—Results obtained with boron oxide and arsenious oxide indicate that the molecular elevation of the boiling point of sulphuric acid is about 53.3 (in fair agreement with the value calculated from the expression  $0.02T^2/W$ ), and that the formula of the former substance is  $B_4O_6$ . It is further indicated that the formula of molybdic acid anhydride is  $Mo_2O_6$ . The molecular weights obtained for sodium and potassium sulphates are considerably less than the normal values, and it is supposed that the potassium or sodium hydrogen sulphate molecules primarily formed react to produce pyrosulphate. In this connection, it is shown that whilst potassium hydrogen sulphate dissolved in concentrated sulphuric acid has an abnormally high molecular weight, the values obtained for sodium and potassium pyrosulphates are nearly normal.

J. C. P.

**Vapour Current Method for the Determination of Molecular Weights at High Temperatures.** ERNST BECKMANN (*Zeit. physikal. Chem.*, 1905, 53, 137—150).—A number of detailed modifications are suggested in the apparatus previously described (*Abstr.*, 1902, ii, 303; *Abstr.*, 1903, ii, 533; see also Walther, *Abstr.*, 1904, ii, 234). The author points out the advantages possessed by the method of direct heating as compared with the method of heating by a current of the vapour.

J. C. P.

**Elimination of Thermometer Lag and Casual Loss of Heat in Calorimetry.** THEODORE W. RICHARDS, LAWRENCE J. HENDERSON, and GEORGE S. FORBES (*Zeit. physikal. Chem.*, 1905, 52, 551—568).—In an ordinary calorimetric determination of the heat developed in a reaction, there are two chief sources of error. Firstly, the real maximum temperature is not reached in the calorimeter through loss of heat to the environment; secondly, the thermometer lags, and cannot indicate with sufficient rapidity the changes of temperature in the calorimeter. The first source of error is usually eliminated by Regnault and Rumford's methods, but the second is generally disregarded. The authors show how the lag may be determined for any given thermometer under given conditions, and how a corresponding correction may be introduced in the results of calorimetric work. Further, they point out that the first source of error mentioned may be eliminated by allowing the temperature of the environment to rise simultaneously with that of the contents of the calorimeter. This is done by allowing a suitable chemical reaction (for example, the neutralisation of acid by alkali) to take place in the external bath surrounding the calorimeter. It is found that this method gives more constant results than the older methods involving calculated corrections for the loss of heat. The results obtained by the new method agree with those obtained by the older methods, provided the latter are corrected for the lag of the thermometer.

J. C. P.

**Thermochemical Studies. Reply to Julius Thomsen.** DANIEL LAGERLÖF (*J. pr. Chem.*, 1905, 72, 80—104).—A polemical paper in which the author replies vigorously to criticisms of Thomsen on the author's previous papers (this vol., ii, 435). He criticises the method of deducing an expression to reproduce experimental results and then claiming from the accord of the experiments and the values calculated by the expression that "the high relative accuracy of the experimental data" is indicated (this vol., ii, 437). He indicates many irregularities and discrepancies in Thomsen's results, and shows that by the author's method of calculation the results of Berthelot appear more regular than those of Thomsen.

L. M. J.

**Calorimetric Measurement of Heats of Combustion.** WILHELM JAEGER and HELMUTH VON STEINWEHR (*Zeit. physikal. Chem.*, 1905, 53, 153—165).—The authors discuss certain problems connected with the determination of heats of combustion in a Berthelot bomb, namely, (1) the possible sources of error in the determination of the water equivalent and in the combustion experiments; (2) the correction for heat exchange with the surroundings; (3) the absolute and relative accuracy of the measurements according to present standards; and (4) the influence on the results of the value of the calorie and its variation with temperature. Special and favourable consideration is given to the electrical method of calibrating a calorimeter (see Fischer and Wrede, *Abstr.*, 1904, ii, 468). Platinum thermometers are recommended in preference to mercury ones for calorimetric work. In connection with point (4) above, it is shown that Fischer and Wrede's



numbers are 0.2—0.3 per cent. too high. For other details of the discussion, the original must be consulted. J. C. P.

**Heat of Formation of Silicates.** D. TSCHERNOBAEFF (*Rev. de Métallurgie*, 1905, 2, 729—736).—The heats of formation of silicates from silica and the metallic carbonate or oxide have been determined by Le Chatelier's method (Abstr., 1895, ii, 305), in which the reacting substances are mixed with wood charcoal in a calorimetric bomb, the temperature reached by the combustion of the carbon being sufficient to cause fusion of the mass. The method of making the necessary corrections is described.

The following results were obtained:  $\text{CaCO}_3 + \text{SiO}_2 = \text{CaSiO}_3 + \text{CO}_2$  - 27.3 Cal.; the corresponding heats of formation of  $\text{Ca}_2\text{SiO}_4$  and  $\text{Ca}_3\text{SiO}_5$  are - 31.0 Cal. and - 36.0 Cal. respectively for 1 mol. of CaO.  $\text{SrCO}_3 + \text{SiO}_2 = \text{SrSiO}_3 + \text{CO}_2$  - 35.1 Cal.,  $\text{BaSiO}_3$  has - 41.0 Cal.;  $\text{Li}_2\text{SiO}_3$  has - 24.9 Cal.;  $\text{Na}_2\text{SiO}_3$  has - 30.4 Cal.

$2\text{SiO}_2 + \text{Al}_2\text{O}_3 + 3\text{CaCO}_3 = 2\text{SiO}_2, \text{Al}_2\text{O}_3, 3\text{CaO} + 3\text{CO}_2$  - 101.9 Cal.;  
 $2\text{SiO}_2, \text{Al}_2\text{O}_3 + 3\text{CaCO}_3 = 2\text{SiO}_2, \text{Al}_2\text{O}_3, 3\text{CaO} + 3\text{CO}_2$  - 116.8 Cal.;  
 $2\text{SiO}_2 + \text{Al}_2\text{O}_3 + 2\text{H}_2\text{O} = 2\text{SiO}_2, \text{Al}_2\text{O}_3, 2\text{H}_2\text{O}$  (kaolin) + 43.8 Cal.

The heat of transformation of quartz into vitreous silica was found to be - 0.9 Cal., but is too small to be determined with accuracy.

C. H. D.

**Heats of Formation of Mixtures and of Non-aqueous Solutions.** WLADIMIR F. TIMOFÉEFF (*Chem. Centr.*, 1905, ii, 429—438; from *Isv. Kieff' Polytechn. Inst.*, 1905, 1—340).—The author has made a very exhaustive study of the heats of solution of gases and solids in organic solvents, and of the heat developed on mixing together various organic liquids, with the object of determining whether it is possible to connect the heats of formation of solutions and mixtures with the physical and chemical properties of the components. Tables giving the thermal capacities (*c*) at 20° and their corresponding temperature-coefficients *dc/dt* show that the greatest values for temperature-coefficient are given by strongly associated substances such as aliphatic alcohols.

**Thermal Capacities of Mixtures.**—Additive relationships are shown by mixtures of benzene with chlorobutane, chloroform, carbon tetrachloride, carbon disulphide, and acetone, of heptane with chloroform, carbon disulphide, and ethyl acetate, and of acetic acid with toluene, pyridine, and ethyl alcohol; such relationships do not hold for mixtures of chloroform with pyridine, ethyl ether, acetone, and acetic acid, of acetic acid with carbon tetrachloride, nitrobenzene, and aniline, of the fatty alcohols with all other liquids, of benzene with aniline, ethyl acetate, and acetic acid, and of heptane with ethyl acetate. In other words, the first group comprises non-associated or slightly associated liquids which have no chemical action on each other with the notable exception of the mixtures of acetic acid with toluene, pyridine, and ethyl alcohol; the second group, on the other hand, contains chiefly associated liquids, or substances such as chloroform, which have a powerful chemical affinity for most solvents. The extent of the deviation from the additive rule is found to diminish in the case of the fatty alcohols with increasing

molecular weight. It appears from this that in the absence of any association on the part of the molecules of the two constituents the thermal capacity of a mixture is an additive function of the thermal capacities of those constituents.

A table giving the heats of solution of hydrogen chloride and ammonia in methyl, ethyl, propyl, and *isobutyl* alcohols of varying concentrations shows that in the case of hydrogen chloride the heat of formation varies inversely as the concentration, whereas in the case of ammonia, owing no doubt to association, it varies directly.

The heat developed when liquids are mixed has been measured in the case of 133 pairs of liquids for different proportions of the constituents, and the results are communicated in more than a hundred tables, which have been summarised in one giving the molecular heat of mixture at infinite dilution for 13 substances in 19 different solvents. By the molecular heat of mixture is meant the heat, expressed in Calories, which is developed when one gram-molecule of a liquid is dissolved in  $x$  gram-molecules of solvent. The pairs of liquids examined may be divided under the following heads: (1) mixtures of normal non-associated chemically indifferent liquids; (2) mixtures of normal liquids which act chemically on each other; (3) mixtures of associated with normal liquids which have no action on each other; (4) mixtures of associated liquids which react with each other. For a detailed discussion regarding each of these cases, reference should be made to the original paper.

The heats of solution of solids in indifferent solvents at concentrations approximating to saturation are practically the same as their heats of fusion. The heats of solution of 18 organic solids in various solvents are tabulated. From observations on the heats of formation and vapour pressures of mixtures of liquids, it is found that a certain parallelism exists between the two phenomena, although the parallelism is by no means rigid. It has not been found possible to recognise any direct relationship between the surface tension, dielectric constants, and volume changes of mixtures and their heats of formation. In addition to the large amount of material collected with regard to organic compounds, the author has also determined the specific heats of solution of mercuric chloride in various alcohols, and the heats of solution of mercuric chloride and cadmium iodide in methyl and ethyl alcohols, ether, and ethyl acetate.

P. H.

**Modification of van't Hoff's Theory of the Depression of the Freezing Point.** J. B. GOEBEL (*Zeit. physikal. Chem.*, 1905, 53, 213—224).—Equations are obtained for the vapour pressure curves of water and ice in the neighbourhood of  $0^{\circ}$ , and these curves are in very close agreement with the experimental results of Magnus, Regnault, and Juhlin. From these equations, with the aid of thermodynamics and on the basis of van't Hoff's molecular theory, the author deduces the relationship  $c' = 0.54\Delta - 0.061\Delta^2 + 0.00154\Delta^3$ , which is valid for dilute aqueous solutions. In this equation,  $\Delta$  is the depression of the freezing point, and  $c'$  is the concentration (in molecules per litre) of the dissolved substance as it actually exists in the solution. For very small depressions, the foregoing formula becomes the same as the

simple van't Hoff equation,  $c' = 0.54\Delta$ . It is probable that the author's formula allows more exact conclusions to be drawn regarding the molecular condition of various solutions. Thus it is shown that the degree of dissociation in salt solutions, and seemingly also the degree of association in alcohol solutions, can be determined in fair harmony with the mass action law.

J. C. P.

**Alteration of Specific Gravity.** GEORG W. A. KAHLBAUM and E. STURM (*Zeit. anorg. Chem.*, 1905, 46, 217—310).—The changes of specific gravity which accompany the deformation of metals by drawing, pressing, twisting, and rolling have been studied, and it has been found that there is a change of specific gravity brought about by the external mechanical action alone; it is suggested that the change, which is always due to an expansion, marks the formation of allotropic modifications. The results are summarised as follows:

Metal.	Sp. gr.	
	Before.	After.
Commercial platinum .....	21.4320	21.4170
Pure platinum .....	21.4403	21.4336
Platiniridium .....	21.4938	21.4766
Gold .....	19.2602	19.2506
Aluminium .....	2.7031	2.6995
Cadmium .....	8.6434	8.6397
Nickel .....	8.8440	8.7599
Alloy of Cu—Al .....	8.2377	8.2237
Wood's alloy * .....	9.6735	9.6661
Alloy IX. * .....	9.2940	9.2837
Alloy VIII. * .....	9.8223	9.7711
Gold .....	19.2322	19.2220
Commercial platinum .....	21.4284	21.4112
Pure platinum .....	21.4312	21.3985
Platiniridium .....	21.3309	21.3150
Nickel .....	8.8412	8.8273

drawn into wire

pressed into wire

wire submitted to torsion

\* The percentage composition of the three alloys was:

	Bi.	Pb.	Cd.	Sn.	M. p.
Wood's alloy .....	50.0	25.0	12.5	12.5	65°
Alloy IX. ....	47.75	18.39	13.31	20.55	71°
Alloy VIII. ....	52.0	32.0		16.0	96°

D. H. J.

**Aqueous Solutions of Fatty Acids.** KARL DRUCKER (*Zeit. physikal. Chem.*, 1905, 52, 641—704).—The experimental part of the work involved the determination of conductivity, density, and surface tension for solutions of formic, acetic, propionic, butyric, isobutyric, *n*-valeric, isovaleric, monochloroacetic, dichloroacetic, and trichloroacetic acids, as also the determination of compressibility for solutions of acetic acid and its chlorine derivatives.

A point of maximum density, already well known for mixtures of acetic acid and water, exists also in the case of aqueous solutions of



the higher homologues. It lies at about 50 per cent. acid concentration for propionic acid, at about 30 per cent. for the butyric acids, and at a smaller concentration still for the valeric acids. No maximum could be detected for formic acid or the chloroacetic acids.

The surface tension of the solutions varies markedly with the concentration and with the position of the acid in the homologous series. The temperature-coefficient exhibits a distinct minimum in several cases, but trichloroacetic acid has a distinct maximum value. The values at 25° of the surface tension  $\gamma$  for acetic acid and its chlorine derivatives in the pure state have been obtained by extrapolation, and are as follows: acetic acid, 26.1; monochloroacetic acid, 41; dichloroacetic acid, 37.2; trichloroacetic acid, 36.0. The order of magnitude of the influence of these acids in dilute solution on the surface tension of water is, however, different from that indicated by the foregoing numbers.

In all the four cases studied, the initial value of the compressibility exhibits a minimum when plotted against the concentration of the solutions, although the extrapolated values for the pure substances are very different, namely, acetic acid, 98; monochloroacetic acid, about 47; di- and tri-chloroacetic acids, 59; water, 47.

The experimental results obtained are used to test a number of theoretical deductions. Thus it is shown that, with the aid of the conception of "apparent" critical constants, van der Waals' constants  $a$  and  $b$  can be calculated for the abnormal associating members of the homologous series of acids, and even for water from the formulæ of Eötvös and of Ramsay and Shields. In the course of these calculations, it is found that of the two van der Waals' formulæ connecting surface tension and critical pressure, the one  $\gamma = \pi \text{ const.}$  is the better. On this basis, it is possible to calculate the surface tension of a normal binary mixture. For mixtures, however, of water and fatty acids, and of water and alcohols, there are deviations from the calculated values, these deviations indicating extensive polymerisation of water, both when in the pure state and when mixed with other substances. Evidence of polymerisation in the cases of water and acetic acid was obtained also from a study of the compressibilities; the higher chlorine derivatives of acetic acid, on the other hand, are found to be normal.

From the compressibilities of variously concentrated solutions of the fatty acids, the changes of internal pressure accompanying the solution process have been calculated; when this change of internal pressure is allowed for in the dissociation formula for trichloroacetic acid, the degree of dissociation can be calculated (up to  $N/2$  concentration) in good agreement with cryoscopic measurements. J. C. P.

**Surface Tension of Inorganic Salt Solutions.** CARL FORCH (*Ann. Physik*, 1905, [iv], 17, 744—762).—In consequence of criticisms of Feustel (*ibid.*, 16, 66), the author has redetermined the surface tension of a number of aqueous solutions of inorganic salts by the drop method, and has compared the values with those obtained by other observers. The various discrepancies throughout all series of determinations led him to consider that the knowledge of the surface

tension is far from accurate, and that whilst different methods, or the same method in the hands of different observers, yield such diverse results even fundamental questions cannot be satisfactorily solved.

L. M. J.

**Diffusion of Nascent Hydrogen through Iron.** ADOLF WINKELMANN (*Ann. Physik*, 1905, [iv], 17, 590—626).—In order to determine the diffusion of nascent hydrogen through iron, an iron tube closed below was used as the cathode of an electrolytic cell. The top of the iron tube was connected to a glass tube divided in millimetres standing in a mercury trough and connected with an air-pump. A solution of sodium hydroxide formed the electrolyte, and the rate of diffusion of the hydrogen produced on the exterior into the interior of the tube was investigated. The effect of internal pressures was examined, and the author finds that the velocity of diffusion is independent of the pressure of hydrogen inside the tube, at least between the limits 0 and 89 cm. of mercury. The velocity was also not affected when the external pressure was reduced from one to one-half atmosphere. The author concludes that the latter fact indicates that the actual pressure of the hydrogen on the outside of the iron tube is not of the same order as the external pressure, and is not less than 58 atmospheres. He, however, considers the independence of internal pressure to indicate probably that the diffusion is of ionic or atomic and not of molecular hydrogen. At constant temperature, the rate of diffusion was found to increase more slowly than the current strength, but to be approximately proportional to the potential difference. The increase with temperature was rapid, and could be given by the expression  $D_t = D_0(1 + 0.0455t)$  for constant current, or  $D_t = D_0(1 + 0.0561t)$  for constant potential difference. L. M. J.

**Solutions of Sugar and Inorganic Salts in Dialysis.** PIO BERLI (*Chem. Centr.*, 1905, ii, 796; from *Bull. Assoc. Chim. Sucr. Dist.*, 22, 1155—1162).—The dialysing power of a 10 per cent. sugar solution increases more quickly than the temperature and solubility. In solutions containing 1 per cent. of a salt ( $K_2CO_3$ ,  $KNO_3$ ,  $KCl$ ,  $Na_2SO_4$ ,  $CaCl_2$ ), the sugar dialysed the less the greater the amount of dialysed salt. Similar results were obtained with solutions containing 15 per cent. of sugar and 5 per cent. of salt, or 5 per cent. of a mixture of equal amounts of each salt. Dialysing power diminishes as the molecular weight and molecular volume increase. N. H. J. M.

**Strong Sterilisable Dialysing Membrane.** HIBBERT W. HILL (*J. Amer. Chem. Soc.*, 1905, 27, 1058—1060).—The membrane described is made by sewing together pieces of closely woven silk so as to form the desired shape and immersing this in a hot aqueous solution of gelatin of 20—30 per cent. strength for about 10—15 minutes. The silk is withdrawn, allowed to drain, and then plunged into water at 0° and left for 5—10 minutes, after which it is removed from the water and tested for leaks. If no flaws are found, the gelatinised silk is put into 40 per cent. solution of formaldehyde at 0°, and left

for about a fortnight or until the gelatin has been rendered completely insoluble in hot water. Finally, the membrane is washed or steamed to remove the free formaldehyde.

The membrane thus prepared is very strong, dialyses well, can be repeatedly sterilised with steam or boiling water, and is therefore well adapted for bacteriological work.

E. G.

**The Clays as Semipermeable Walls.** PAUL ROHLAND (*Zeit. Elektrochem.*, 1905, 11, 455—456).—The plastic clays, in the air-dried condition, allow crystalloids to diffuse through them, but not colloids. This property appears to be connected with the presence of inorganic and organic colloidal material in the clay.

T. E.

**Indifferent Points.** PAUL SAUREL (*J. Physical Chem.*, 1905, 9, 556—557).—The temperature (or pressure) of an indifferent point corresponding with a given pressure (or temperature) is a maximum or minimum of the temperatures (or pressures) at which the system can be in equilibrium at the given pressure (or temperature), and the author defines certain conditions in which it is possible to assert whether the temperature will be a maximum or the pressure a minimum (Abstr., 1904, ii, 715).

L. M. J.

**Thermodynamic Potential and its Application to Problems of Chemical Equilibrium.** JOHANNES J. VAN LAAR (*Chem. Centr.*, 1905, 2, 734—735; from *Chem. Weekblad.*, 1905, ii, 427—440).—Several cases of dissociation are considered from the point of view of thermodynamic potential. With the aid of the molecular potentials, Gibbs' formula for the dependence of gaseous dissociation on the pressure and the temperature can be deduced. For details, the original must be consulted.

H. M.

**Shape of the Sections of the Surface of Saturation Normal to the  $x$ -Axis in case of a Three-phase Pressure between Two Temperatures.** JOHANNES D. VAN DER WAALS (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 184—193).—A theoretical paper.

J. C. P.

**The ( $T, x$ ) Equilibria of Solid and Fluid Phases for Variable Values of the Pressure.** JOHANNES D. VAN DER WAALS (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 193—195).—A theoretical paper.

J. C. P.

**Hidden Equilibria in the  $p$ - $x$ -Diagram of a Binary System in Consequence of the Appearance of Solid Substances.** ANDREAS SMITS (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 196—200).—Theoretical.

J. C. P.

**Contribution to the Knowledge of the  $p$ - $x$ - and  $p$ - $T$ -Lines for the Case that Two Substances enter into a Combination which is dissociated in the Liquid and the Gas Phase.** ANDREAS SMITS (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 200—208).—A theoretical paper.

J. C. P.



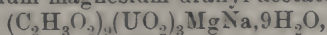
**Phenomena observed when the Plait Curve meets the Solubility Curve.** ANDREAS SMITS (*Zeit. physikal. Chem.*, 1905, 52, 587—601).—The experiments with ether and anthraquinone (*Abstr.*, 1904, ii, 15) have been extended, and the results support the theoretical views recently advanced (this vol., ii, 234). J. C. P.

**Influence of the Solvent on the Equilibrium Constant, and the Relationship between Electric Conductivity and Viscosity.** LEO PISSARJEWSKY and N. LEMCKE (*Zeit. physikal. Chem.*, 1905, 52, 479—493).—Part of this work has already been described (this vol., ii, 16). In discussing the effect of adding alcohol or glycerol on the dissociation of potassium chloride and sulphate in aqueous solution, and indirectly on the equilibrium in question (*loc. cit.*), the authors arrive at the view that the degree of dissociation is given by the formula  $\alpha = \mu \cdot \eta / \mu_{\infty} \cdot \eta_{\infty}$ , where  $\mu$  and  $\eta$  are molecular conductivity and viscosity respectively. The conductivity and viscosity of solutions of sodium chloride in aqueous glycerol have been determined, and the application of the foregoing formula indicates that the degree of dissociation in aqueous glycerol is greater than in water. With sodium chloride as solute, the value of  $\mu_{\infty} \cdot \eta_{\infty}$  is practically the same for each of the three solvents, (1) water, (2) 9.87 per cent. aqueous glycerol, (3) 10.54 per cent. mannitol in water. The degree of dissociation of sodium chloride in mannitol solutions is sometimes greater, sometimes less, than in water. The viscosity of sodium chloride solutions in (1) aqueous glycerol, (2) aqueous solution of mannitol, rises and falls periodically with the dilution. The viscosity of an aqueous solution of sodium chloride between  $v=64$  and  $v=512$  is smaller than that of pure water, the minimum value being obtained at  $v=128$ . This is in harmony with Arrhenius' views. J. C. P.

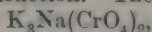
**Dineric Equilibria.** JAMES M. BELL (*J. Physical Chem.*, 1905, 9, 531—555).—Bancroft has shown that the equilibrium between two non-miscible liquids dissolved in a consolute liquid is expressed by the equation  $x^a y^b / z^{a+b} = K$  where  $x$ ,  $y$ , and  $z$  are the respective concentrations (*Abstr.*, 1895, ii, 157). The validity of this has also been demonstrated by Lincoln (*Abstr.*, 1900, ii, 302). If one or both the liquids are only partially soluble in the third, the expression reduces to  $(x+A)^a y^b / z^{a+b} = K$  or  $(x+A)^a (y+B)^b / z^{a+b} = K$ . The author has investigated the case where the addition of liquid  $z$  to the solution of a solid in liquid 1 caused the precipitation of a liquid phase and not of the solid itself. Assuming this to be an example of the first case, the equation may be reduced to  $z^n / y = K$  if the quantity of solid is kept constant. It is shown that when the solid is a non-electrolyte this expression holds well, the constants having different values for the two liquid phases; when, however, electrolytes were employed, the equation does not hold, as, for example, in the case of potassium carbonate, alcohol, water. It is possible that the lack of accord in such a case is ascribable to dissociation. As the quantity  $x$  is not varied, these results do not prove the applicability of the first equation, but indicate that the equilibrium is to be represented by the equation  $f(x) y^b / z^{\gamma} = K$ , where the function  $f(x)$  is not known.

L. M. J.

**Transformation of Polymorphic Substances.** HERMANN STEINMETZ (*Zeit. physikal. Chem.*, 1905, 52, 449—466).—A study, with the aid of the dilatometer, of the transition points of a number of substances. Sodium magnesium uranyl acetate,



has a transition point at  $27.5^\circ$  under atmospheric pressure, the change in crystalline character being monoclinic pseudo-hexagonal  $\rightarrow$  hexagonal. The transition is not accompanied by any appreciable volume change or heat effect, but the coefficient of expansion becomes less above the transition temperature. Under a pressure of 53 kilos. per sq. cm., the transition temperature is  $30^\circ$ , and the transformation is then accompanied by an expansion of about 0.2 per cent. *iso*Propylamine platinichloride,  $(\text{CH}_2\text{Me}_2\cdot\text{NH}_2)_2\cdot\text{H}_2\text{PtCl}_6$ , undergoes at  $32^\circ$  under atmospheric pressure a change from monoclinic pseudorhombic aggregates into definite rhombic crystals. The transformation involves an expansion of about 0.04 per cent., but is unaccompanied by any heat effect. The coefficient of expansion alters as in the case of the uranium compound mentioned above. Under a pressure of 53 kg. per sq. cm., the transition point is  $0.5^\circ$  higher, and the accompanying volume change is slightly less. Other substances have been examined in less detail. Sodium-katapleite, a calcium sodium zirconium silicate, has a transition point at  $35^\circ$ , undergoing a very small change of volume. Tridymite has a transition point at  $115^\circ$ , and its volume expands about 0.6 per cent. Calcium chloroaluminate,  $\text{AlO}_3\text{Ca}(\text{CaCl})3\text{H}_2\text{O}, 2\text{H}_2\text{O}$ , has a transition point at  $35.8^\circ$ , its volume undergoing a contraction. The double chromate,



undergoes a gradual change between  $150^\circ$  and  $175^\circ$  without appreciable alteration of volume or expansion coefficient. Leadhillite has a transition point at  $115^\circ$ ; the change is monoclinic pseudorhombic  $\rightarrow$  rhombic, and is accompanied by considerable expansion. In the case of hexachloroethane, there are two transformations, rhombic  $\rightarrow$  triclinic at  $45^\circ$ , and triclinic  $\rightarrow$  cubic at  $71^\circ$ . In each case the change is accompanied by a considerable expansion. The transformation of carbon tetrabromide also is accompanied by a marked increase in volume.

J. C. P.

**Mixed Crystals in Systems of Three Substances.** III. FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1905, 52, 513—550).—A continuation of the earlier papers (this vol., ii, 154, 376).

J. C. P.

**Indirect Analyses in Multi-component Systems.** WILDER D. BANCROFT (*J. Physical Chem.*, 1905, 9, 558—561).—An extension of a paper on this subject by Browne (*Abst.*, 1902, ii, 648). If the analyses of a fused mass and of the mother liquor after crystallisation be known, it will probably be found that the ratios of some of the constituents are identical or nearly so. It may be assumed that these have not separated, and if the analyses be referred to unit mass of one of these constituents, the analysis of the separated crystals may be obtained by subtraction of the analysis of the mother liquor from that of the fused mass. Examples are given.

L. M. J.

**Foundations of a General Theory of the Electrolytic Solution Tensions of Substances in any Solvent.** CARL FREDENHAGEN (*Zeit. Elektrochem.*, 1905, 11, 496—502).—If a partially dissociated binary compound  $KA$  in the gaseous condition is acted on by a substance  $E$ , the component  $K$  will be liberated, no action will occur, or the component  $A$  will be liberated, according as the equilibrium constant of the reaction  $E + A = EA$  is greater than, equal to, or less than the constant of the reaction  $E + K = EK$ . It may be assumed that the same thing would occur in the liquid state. Taking water as an example, the elements may be divided into three groups according to whether their affinity for hydroxyl is greater than, equal to, or less than their affinity for hydrogen; group (1) contains the metals, group (2) contains As, B, P, N, C, and group (3) contains the typical non-metals. These groups are electro-positive, neutral, or electro-negative to water. Since reactions in gases are supposed to take place between ordinary molecules and in liquids between charged ions, this connection is not obvious. The author regards the hypothesis of charged ions as unnecessary. Electrolytic dissociation differs from ordinary dissociation in the fact that in the former the products of dissociation are "coupled" and cannot be removed from the system independently of each other. If the temperature of an electrolytic solution be raised gradually past the critical temperature, it passes into a condition of ordinary dissociation, hence electrolytic dissociation is caused by molecular attractions. The fact that "dissociating" solvents all possess large surface tension and large heat of evaporation is in accordance with this. The connection between the affinity of a substance for the dissociation products of a solvent, the molecular forces within the solvent, and the solubility of the substance is also discussed.

T. E.

**Application to Electrolytes of the Hydrate Theory of Solutions.** T. MARTIN LOWRY (*Trans. Faraday Soc.*, 1905, 1, 197—206).—An attempt is made to extend the hydrate theory to electrolytes in such a way as to take account of the observations which form the experimental basis of the theory of electrolytic dissociation. The ionisation of an aqueous electrolyte is supposed to consist in a further process of hydration whereby the fully hydrated molecule combines with an additional quantity of water to form two or more hydrated ions. The theory is in accord with the fact that the best ionising solvents are those which are themselves most highly associated, that complete ionisation is only possible in presence of a large excess of water in the case of aqueous solutions, and that the proportion of water required to produce a given degree of ionisation steadily increases as the temperature rises. Further evidence is furnished by the relative values of the ionic mobilities and the relationships existing between the fluidity of solutions and their electrical conductivity. The large mobilities of the  $H^+$  and  $OH^-$  ions indicate that these are either anhydrous or less hydrated than other ions. The minimum values of the molecular lowering of the freezing point which have been observed for many aqueous salt solutions between 0.1 and 0.5 normal concentrations can also be satisfactorily explained.



For a given solution the chief constants are  $H$ , the total hydration, which expresses the total number of molecules of water per molecule of solute,  $h$ , the average molecular hydration, and  $\beta$ , the coefficient of combination, which is the fraction of the total number of water molecules actually combined with the solute to form hydrates. These constants are connected by the equation  $h = \beta H$ .

On the basis of freezing-point data, the molecular hydration of aluminium chloride in solutions varying in concentration from 2.1 to 0.20 molecular has been calculated, and the values of  $H$ ,  $h$ , and  $\beta$  are tabulated. As the concentration decreases from 2.1 to 0.2 molecules per litre, the value of  $h$  increases from 20.6 to 35.7. At greater dilutions there is an abrupt fall in the value of  $h$ , but this is attributable to experimental errors.

The hydrate theory is applicable without any substantial alteration to all cases of heterolytic conductivity in which the electrolytic properties are due to the interaction of the solute with an ionising solvent. To extend it to autolytes (fused conductors), it is necessary to assume that the mechanism of electrolysis is similar to that which obtains in solution, and that only a part of the fused salt is directly active. In this case the ions are associated with several molecules of the salt instead of with solvent molecules. Facts are cited which support the view that such complex ions are formed.

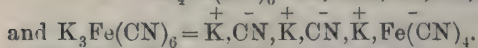
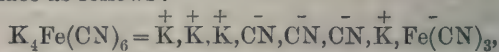
H. M. D.

**Approximate Composition of the Hydrates formed by a Number of Electrolytes in Aqueous Solutions, together with a Brief General Discussion of the Results thus far obtained.**

**XIII.** HARRY C. JONES and H. P. BASSETT (*Amer. Chem. J.*, 1905, 34, 290—349. Compare this vol., ii, 445; *Abstr.*, 1904, ii, 386, 710, and earlier abstracts).—In continuation of the previous work, experiments have been carried out in order to obtain the data necessary for calculating the approximate composition of the hydrates formed in solutions at various concentrations. The depression of the freezing point, the conductivity at 0°, and the sp. gr. have been determined of solutions of different concentrations of lithium iodide, sodium bromide, strontium nitrate, barium iodide, cadmium nitrate, chromium chloride, potassium ferrocyanide, potassium ferricyanide, sodium chromate, sodium dichromate, disodium hydrogen phosphate, ammonium cupric chloride, potassium cupric chloride, ammonium sodium hydrogen phosphate, hydrochloric acid, hydrobromic acid, nitric acid, phosphoric acid, chromic acid, sodium hydroxide, potassium hydroxide, and ammonium hydroxide. The results are tabulated and plotted as curves.

It has been shown previously that, as a rule, the number of mols. of water combined with 1 mol. of the dissolved substance increases from the most concentrated to the most dilute solution. In the case of hydrochloric, hydrobromic, nitric, and sulphuric acids, however, it is found that, starting with the more concentrated and passing to the more dilute solutions, the number of mols. of water in combination with 1 mol. of the acid passes through a maximum which is reached at a concentration of about 2*N*.

From the experiments made with potassium ferrocyanide and potassium ferricyanide, it is concluded that the dissociation of these salts takes place as follows :



The following additional evidence is brought forward in favour of the theory of the existence of hydrates in solution. When a small quantity of crystallised calcium chloride or aluminium chloride is added to a fairly strong solution of cobalt chloride, the red colour of the solution is changed to blue. This change proves that calcium chloride with  $6\text{H}_2\text{O}$  can, in solution, unite with a still larger quantity of water, as shown by the partial dehydration of the cobalt chloride. A similar change can be effected by the addition of salts with large hydrating power to dilute solutions of cupric bromide.

It is shown by reference to the literature that the number of mols. of water of crystallisation of a salt is greater the lower the temperature at which the salt is crystallised, and several examples are given to illustrate this fact, which, it is pointed out, affords strong evidence in support of the hydrate theory.

The paper concludes with a general discussion of all the results hitherto obtained, and a summary of the conclusions arrived at.

E. G.

**Colorimetry and a Colorimetric Method for determining the Dissociation Constant of Acids.** F. H. EIJDMAN (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 166—175).—The experiments described in this paper have been carried out with a modified form of Wolff's colorimeter.

If a solution of an indicator acid (that is, an acid the anions of which have not the same colour as the acid itself) is diluted with water, the colour, as observed in the colorimeter tube, changes in the direction of the colour of the anions. If now a fairly concentrated solution of a colourless acid, HA, is gradually added until the original tint is restored in the colorimeter tube, the solution prepared from the added water and the concentrated solution of HA must be isohydric with the solution of the indicator acid. The same operation may now be repeated with another colourless acid, HA', and it is thus possible to discover the concentrations of isohydric solutions of the two acids HA and HA'. Hence, if the dissociation constant of HA is known, that of HA' may be calculated. This has been done with satisfactory results in a number of cases.

J. C. P.

**Hydrolysis of Esters in Heterogeneous Systems.** ROBERT KREMANN (*Zeit. Elektrochem.*, 1905, 11, 558—560).—A reply to Goldschmidt (this vol., ii, 578).

T. E.

**Salt Solutions in Mixtures of Alcohol and Water.** A. FLECK-ENSTEIN (*Chem. Centr.*, 1905, ii, 424; from *Physikal. Zeit.*, 1905, 6, 419—422).—The solubility of ammonium nitrate at different temperatures in methyl and ethyl alcohols, in water, and in aqueous alcohols was determined by dissolving known weights of the salt in the

respective solvents and reading the temperatures at which it began to be deposited from solution. In the case of ethyl alcohol, the increase of solubility is slow and is a linear function of the temperature, whereas in the case of methyl alcohol and of water the solubility increases more rapidly than the temperature. The addition of ethyl alcohol to an aqueous solution of the nitrate diminishes its solubility, whilst methyl alcohol increases it. The solubility in the mixed solvents could only be calculated at high temperatures from the law of mixtures. The formation of layers in the case of mixtures of nitrate, water, and ethyl alcohol was observed within certain limits of temperature and concentration only, and was found to depend on the amount of alcohol and not on the amount of salt. The temperature at which this separation into layers takes place varies directly as the amount of alcohol present; the phenomenon is only observed in the presence of undissolved salt. The volumes, as well as the composition, of the layers vary very much with the temperature, which is contrary to the observations of Traube and Neuberg (compare Abstr., 1888, 783) on mixtures of ammonium sulphate, water, and ethyl alcohol.

P. H.

#### Hydrolytic Decomposition in Non-aqueous Solutions.

GIUSEPPE BRUNI and ANTONIO MANUELLI (*Zeit. Elektrochem.*, 1905, 11, 554—555).—Formamide and acetamide are dissociated to a greater extent than water. It is therefore to be expected that they will decompose salts in an analogous way. A solution of antimony trichloride (3 grams) in formamide (5 grams) when mixed with 100 grams of the latter gives a precipitate, the composition of which lies between those of the substances  $\text{SbCl}(\text{NH}\cdot\text{COH})_2$  and  $\text{Sb}(\text{NH}\cdot\text{COH})_3$ . When a smaller dilution is used, the composition of the precipitate corresponds with that of the first. Bismuth trichloride dissolved in formamide and antimony trichloride dissolved in acetamide behave in a similar way.

T. E.

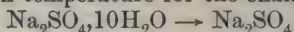
**Colloidal Solutions.** CARL BENEDICKS (*Zeit. physikal. Chem.*, 1905, 52, 733—736).—The author suggests that the relation of troosite to martensite on the one hand and perlite on the other is analogous to the position of a colloidal solution intermediate between its original homogeneous solution and the resultant system of solution + precipitated substance.

J. C. P.

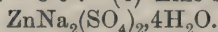
**Formation and Solubility of Analogous Double Salts.** IVAN KOPPEL [with H. WETZEL and A. GUMPERZ] (*Zeit. physikal. Chem.*, 1905, 52, 385—436).—The author has investigated fully the conditions of existence of a series of double salts containing a common component, with the view of eliminating the influence of the accidental factors (temperature, pressure, and concentration), and detecting, if possible, those properties of the components which determine the existence and properties of the double salt. The double salts chosen for the investigation were those of the type  $\text{Na}_2\text{R}''(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$ , and the data sought in each case were the various transition points and the solubility at intervals up to  $40^\circ$  of (1) the separate components, (2) the double salt, (3) double salt + first component, (4) double salt



+ second component. Details regarding two salts of the series in question are already available, namely, for the salt  $\text{MgNa}_2(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$  (Roozeboom, Abstr., 1888, 1164), and for the salt  $\text{CuNa}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$  (Koppel, Abstr., 1903, ii, 78). The following other salts have been prepared, generally by mixing molecular quantities of the components at  $25^\circ$  or  $30^\circ$ ; their composition has been ascertained and the conditions of their formation studied: (1) cobalt sodium sulphate,  $\text{CoNa}_2(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ . The temperature of formation of this double salt is  $17.5^\circ$ ; the transition temperature for the change



is  $31.5^\circ$  in presence of the double salt; the cryohydric point for cobalt sulphate heptahydrate is  $-3.0^\circ$ , but  $-4.5^\circ$  for a mixture of the heptahydrate and sodium sulphate decahydrate. (2) Nickel sodium sulphate,  $\text{NiNa}_2(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ . The temperature of formation is  $16.5^\circ$ ; the sodium sulphate transition point is  $31.8^\circ$  in presence of the double salt. The cryohydric points for (a) nickel sulphate heptahydrate and (b) a mixture of the heptahydrate and sodium sulphate decahydrate are  $-3.9^\circ$  and  $-5.1^\circ$  respectively. (3) Ferrous sodium sulphate,  $\text{FeNa}_2(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ . The temperature of formation is  $18.5^\circ$ ; the sodium sulphate transition point is  $31.4^\circ$  in presence of this double salt; the two cryohydric points corresponding with those previously mentioned are  $-2.0^\circ$  and  $-3.0^\circ$ . (4) Zinc sodium sulphate,



The temperature of formation is  $8.7^\circ$ ; the temperature of the transition  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O} \rightarrow \text{ZnSO}_4 \cdot 6\text{H}_2\text{O}$  is  $37.4^\circ$  in presence of the double salt; the sodium sulphate transition point is  $31.5^\circ$  in presence of the double salt; the cryohydric points are  $-6.5^\circ$  and  $-8.3^\circ$ . (5) Cadmium sodium sulphate,  $\text{CdNa}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ . The temperature of formation is  $-14.8^\circ$ ; the sodium sulphate transition point is  $31.0^\circ$  in presence of the double salt; the two cryohydric temperatures are  $-16.8^\circ$  and  $-17.7^\circ$ .

It is noteworthy that the only double salts crystallising with  $2\text{H}_2\text{O}$  instead of  $4\text{H}_2\text{O}$  are those containing copper and cadmium, the sulphates of which crystallise with fewer than the normal seven molecules of water. The analogy of the double salts is well seen when the solubility curves for the various systems are represented graphically and compared. The temperature-coefficients of the solubilities of the different double salts are also much alike. The transition interval is small for all the double salts studied. The application of the law of mass action to a solution saturated with the two components and kept below the temperature of formation leads to the conclusion that for analogous salts, the stability range of which is reached by raising the temperature, a small solubility of the double salt, or a high solubility of the components, makes for a low temperature of formation. This conclusion is in general supported by the experimental evidence. J. C. P.

**Use of the Differential Equation in Calculating the Results of Kinetic Measurements; the Reaction between Arsenic Acid and Potassium Iodide near the Equilibrium.** W. C. BRAY (*J. Physical Chem.*, 1905, 9, 573—587).—In certain cases in which the rate of a reaction is being investigated, the integrated expression may be so complicated that it is difficult to obtain values for the constants.

The author indicates a method by the use of the differential equation itself. A preliminary constant is first calculated from as simple an equation as possible, and from this the final constant is obtained from the differential equation. In these cases the values  $dx/dt$  must be taken from a curve representing  $x$  against  $t$ . The applicability of the method of investigation is proved by applying it to the results obtained by Roebuck for the reaction between arsenic acid and potassium iodide (Abstr., 1903, ii, 14), and the final result of the recalculations is that there is better agreement with the theory than was claimed in the original paper.

L. M. J.

**Kinetic Study of Organic Reactions.** HEINRICH GOLDSCHMIDT (*Chem. Centr.*, 1905, ii, 749—750; from *Naturw. Rundsch.*, 1905, 20, 365—368).—The reduction of the three nitrophenols, nitroanilines, nitrobenzoic acids, and nitrobenzenesulphonic acids, and of *o*-nitrobenzaldehyde in alkaline tin solutions has been studied.

The equilibrium between stannous hydroxide, sodium hydroxide, and monosodium stannite is represented by the equation

$$[\text{Sn}(\text{OH})_2] \cdot [\text{NaOH}] / [\text{NaHSnO}_2] = K.$$

When stannous hydroxide is present as a solid phase, its concentration is constant, and experiments under these conditions show that the ratio  $[\text{NaOH}] / [\text{NaHSnO}_2]$  is constant = 2.2 over a large concentration interval. The solubility of stannous hydroxide is 0.000014 mol. per litre, from which it is calculated that the hydrolytic constant of monosodium stannite has the value 0.00003, and the affinity constant of stannous hydroxide, regarded as a monobasic acid, the value  $4 \cdot 10^{-10}$ . If the solution is acted on by free oxygen, the concentration of the sodium hydroxide is diminished in consequence of the formation of sodium stannate.

The velocity of reduction when the concentration of the nitro-compound and of the stannous hydroxide is very small and the concentration of the alkali is constant is given by the equation  $v = k \cdot C_{\text{NO}_2} \cdot C_{\text{Sn}}$ . It would appear, however, that two reducing substances are present in the alkaline solution, one of which is supposed to be the ion  $\text{HSnO}_2^-$ , the other undissociated  $\text{NaHSnO}_2$ , and the general expression for the rate of reduction is  $v = k \cdot C_{\text{NO}_2} \cdot C_{\text{HSnO}_2^-} + k' \cdot C_{\text{NO}_2} \cdot C_{\text{NaHSnO}_2} \cdot C_{\text{OH}^-}$ . The factor  $C_{\text{OH}^-}$  in the second term expresses the fact that the influence of the sodium hydroxide is greater than that which corresponds simply with a diminution of the dissociation of the sodium salt.

On reduction of *o*- and *p*-nitrophenols, *o*- and *p*-nitroanilines pass directly into the amines; the corresponding meta-compounds and the other nitro-compounds examined give rise to mixtures of azo- and azoxy-compounds. *o*-Nitrobenzoic acid is an exception and forms a hydroxylamine derivative.

The mechanism of the process is represented by the equations (1)  $\text{RNO}_2 - \text{O} = \text{RNO}$ , (2)  $\text{RNO} - \text{O} = \text{RN}=\text{O}$ , (3)  $2\text{RN}=\text{O} = \text{RN}=\text{NR}$ , or  $\text{RN}=\text{O} + \text{H}_2\text{O} = \text{RNH} \cdot \text{OH}$ .

The rate of reduction of the nitro-compounds by stannous chloride in hydrochloric acid solution is expressed by the equation

$$v = k \cdot C_{\text{NO}_2} \cdot C_{\text{SnCl}_2} \cdot C_{\text{HCl}}.$$

Replacement of the hydrochloric acid by sodium chloride produces no alteration in the velocity, and the author concludes that the process is a reaction in which complex halogen ions,  $\text{SnCl}_3'$ , act the part of a catalyst. Addition of potassium iodide has a similar effect, and the reduction by stannous bromide is accelerated by the addition of potassium bromide. The author's view of the reduction agrees with that of Haber and is expressed by the equations (1)  $\text{R}\cdot\text{NO}_2 + 2\text{H} = \text{R}\cdot\text{NO} + \text{H}_2\text{O}$ , (2)  $\text{R}\cdot\text{NO} + 2\text{H} = \text{R}\cdot\text{NH}\cdot\text{OH}$ , (3)  $\text{R}\cdot\text{NH}\cdot\text{OH} + 2\text{H} = \text{R}\cdot\text{NH}_2 + \text{H}_2\text{O}$ , the first and third reactions taking place with finite, the second with infinitely great velocity.

H. M. D.

**Oxidation and Reduction.** NICOLAAS SCHOORL (*Rec. Trav. chim.*, 1905, [ii], 24, 327—330).—A theoretical paper.

M. A. W.

**Mechanism of the Beckmann Intramolecular Transformation.** C. H. SLUITER (*Rec. Trav. chim.*, 1905, [ii], 24, 372—376).—An account of work already published (compare Lobry de Bruyn and Sluiter, *Abstr.*, 1904, ii, 473).

M. A. W.

**A New Case of Catalysis by Hydrogen Ions.** GEORG BREIDIG and W. FRAENKEL (*Zeit. Elektrochem.*, 1905, 11, 525—528).—The velocity of hydrolysis of ethyl diazoacetate into nitrogen and ethyl glycolate in presence of hydrogen ions is shown to be strictly proportional to the concentration of the undecomposed ester (at constant temperature), and also very nearly proportional to the concentration of the hydrogen ions calculated from the conductivity. The following average values are given for the ratio of velocity constant and concentration of hydrogen ions: nitric and picric acids 34.9, acetic, succinic, and benzoic acids 32.5. The reaction takes place rapidly in presence of very small quantities of hydrogen ions (in presence of 1/2000 *N*-nitric acid at 25°, it is half finished in  $\frac{3}{4}$  hour); it is, therefore, very well suited for the estimation of very small concentrations of hydrogen ions.

T. E.

**Heterogeneous Catalytic Reactions. III. Catalytic Influence of Silica on the Reaction  $2\text{CO} + \text{O}_2 = 2\text{CO}_2$ .** MAX BODENSTEIN and FRIEDRICH OHLMER (*Zeit. physikal. Chem.*, 1905, 53, 166—176. Compare Kühl, *Abstr.*, 1903, ii, 639).—The reaction  $2\text{CO} + \text{O}_2 = 2\text{CO}_2$  is catalytically accelerated when it takes place in a vessel of quartz-glass. The rate of the change is adequately represented by the empirical formula  $dx/dt = k(m + a - x)/(n + b - x)$ , where  $a$  and  $b$  are the initial concentrations of oxygen and carbon monoxide respectively,  $m$  and  $n$  are constants. The chief feature of the investigation is the fact that carbon monoxide retards its own combustion in the quartz-glass vessel, so that the velocity of the reaction is almost inversely proportional to the concentration of carbon monoxide. This, therefore, is to be regarded as a case of negative autocatalysis. This peculiarity is not observed when the reaction takes place in an ordinary glass vessel containing pieces of quartzite or rock crystal. With both these catalysers, the reaction velocity is directly proportional to the carbon



monoxide concentration, and proportional also, although only roughly, to the square root of the oxygen concentration.

In all cases, the temperature-coefficient (for an interval of  $10^\circ$ ) was between 1.4 and 1.8. J. C. P.

**Catalysis by Ferments.** HANS EULER (*Zeit. physiol. Chem.*, 1905, 45, 420—447. Compare this vol., ii, 378).—A review is given of the physico-chemical measurements hitherto made relating to ferment action. The influence of substrate and ferment concentration on the reaction formula is given in tabular form. These fall into certain systems.

The exceptions noted in the simple reaction laws have been attributed by most authors to an intermediary union between the ferment and the substrate; although this is not entirely satisfactory, it is at present the best available explanation. The methods of action of ferments and inorganic catalytic agents proceed on similar lines. Both increase the concentration of the active molecules. W. D. H.

**Experimental Demonstration of the Indestructibility of Matter and of the Law of Multiple Proportions. Structure of the Bunsen Flame. Two Alloys.** JOSEPH HABERMANN (*Chem. Centr.*, 1905, ii, 379; from *Verh. naturf. Ver. Brünn.*, 1905, 43).—It may be shown that a closed 250 c.c. flask filled with hydrogen and containing 0.5 gram of finely-powdered copper oxide undergoes no change in weight if gently heated until the oxide is reduced to metallic copper.

Sodium hydrogen carbonate reacts with barium chloride as follows: (i)  $2\text{NaHCO}_3 + \text{BaCl}_2 = 2\text{NaCl} + \text{BaCO}_3 + \text{H}_2\text{O} + \text{CO}_2$ ; the addition of hydrochloric acid to this mixture produces the evolution of a further quantity of carbon dioxide (ii)  $\text{BaCO}_3 + 2\text{HCl} = \text{BaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ , equal in volume to that produced according to equation (i). The law may be demonstrated by collecting the two volumes successively in an apparatus specially adapted for the purpose.

A modification of the experiments of Teclu (compare *Abstr.*, 1891, 1309) and Haber and Richardt (*Abstr.*, 1904, ii, 166) is devised to show the structure of the Bunsen flame.

The small amount of iron found in two samples of alloys of copper, zinc, and iron which had been used in covering a roof is attributed to the removal of this metal by atmospheric agency. P. H.

**The Condition which determines the Chemical Similarity of Elements and Radicles.** GEOFFREY MARTIN (*J. Physical Chem.*, 1905, 9, 562—572).—If the ratios of the heats of combination of chlorine and bromine with metals be compared, it will be found that the ratios are almost independent of the combining metal. Thus in the case of fifteen metals investigated, the ratios only vary between 1.11 and 1.34. In the case of elements such as iodine and oxygen, the ratios vary greatly, for example (excluding negative signs), 0.21 to 3.78. This constancy of ratio the author considers to be the condition of similarity, and is exemplified by the cases of fluorine and chlorine,

sodium and potassium, potassium and caesium, zinc and cadmium, boron and silicon, calcium and strontium, strontium and barium, nickel and cobalt, antimony and bismuth.

L. M. J.

**Dewar's Method of Producing High Vacua.** LORD BLYTHSWOOD and H. S. ALLEN (*Phil. Mag.*, 1905, [vi], 10, 497—512. Compare Dewar, *Proc. Roy. Soc.*, 1904, 74, 122, and Abstr., 1904, ii, 652).—Dewar's method is applicable in the exhaustion of large receivers, and only a moderate amount of liquid air is required. The amount of air absorbed by a given quantity of charcoal at the temperature of liquid air is nearly independent of the pressure. The rate of absorption at any moment is proportional to the difference between the total amount of air that can be absorbed and the amount already absorbed.

J. C. P.

**Lecture Experiments.** ROBERTO SALVADORI (*Gazzetta*, 1905, 35, ii, 27—28).—The apparatus employed by the author to demonstrate the law of conservation of weight during chemical reactions and the laws of combination of gases by volume consists of a glass tube divided by means of three stopcocks into two parts of equal capacity. One of these parts can be filled, for example, with ammonia and the other with hydrogen chloride, and it can then be shown that no change in weight accompanies the reaction taking place on opening the middle cock. The method of using the apparatus to show the combination of different gases in equal or multiple volumes is obvious

T. H. P.

**Lecture Experiment for the Demonstration of Solid Solutions.** ERNST BECKMANN (*Zeit. physikal. Chem.*, 1905, 53, 151—152).—As was shown some time ago by the author, solutions of iodine in *p*-xylene deposit the pure solvent on freezing, whilst from solutions of iodine in benzene a solid solution is obtained on freezing. If solutions of iodine in these two solvents are partially frozen, and the crystals separated from the mother liquors in a suitable centrifugal machine, the difference is at once apparent.

J. C. P.

**New Laboratory Apparatus.** OTTORINO ANGELUCCI (*Gazzetta*, 1905, 35, ii, 142—144).—The author describes: (1) an automatic apparatus for washing precipitates and (2) a constant-level feeding siphon, by means of which it is possible to keep water circulating in a vessel and to maintain the level of the water at a constant height.

T. H. P.

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## Inorganic Chemistry.

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**Reducing Action of Hydrogen.** ALFRED C. CHAPMAN and H. D. LAW (*Analyst*, 1905, 30, 306—307).—In the case of dilute sulphuric acid and zinc, hydrogen is only liberated when the solution tension of the metal is greater than that of hydrogen, which is about 1 volt, whilst the solution tension of zinc is about 1.7 volts. Every metal, however, exerts a retaining effect on the hydrogen formed at its surface, so that a potential far in excess of that of the hydrogen electrode is necessary before any free hydrogen is liberated. This excess of potential is known as supertension. Metals, such as palladium, platinum, copper, nickel, cobalt, silver, and iron, having low supertensions, when deposited on the surface of pure zinc increase the rate at which the hydrogen is liberated, but reduce its activity to such an extent that it is incapable of reducing such substances as arsenic oxide, &c. Cadmium, lead, and tin, which have high supertensions, have no effect on the reducing power of the zinc. These considerations explain the insensitiveness of some samples of zinc in the Marsh-Berzelius test.

W. P. S.

**Union of Hydrogen with Oxygen at Low Pressures caused by the Heating of Platinum.** P. J. KIRKBY (*Phil. Mag.*, 1905, [vi], 10, 467—476).—Platinum in the presence of hydrogen and oxygen at a low pressure does not cause these gases to combine perceptibly, unless its temperature exceeds a certain critical value. This value is nearly independent of the pressure of the mixed gases (at least for pressures between 2 and 40 mm. mercury) and lies at about 275° for pure platinum; for impure platinum, this critical temperature appears to be lower. When the combination of the gases has once been started by heating the platinum sufficiently, the reaction may be temporarily renewed by raising the platinum to a temperature distinctly lower than that required to start the reaction. The reaction between the gases is not produced by the mere heating to a temperature at which they combine spontaneously, but probably is connected with the corpuscular discharge which is known to be emitted by platinum.

J. C. P.

**Cause of the Green Tint of Natural Waters.** WALTHER SPRING (*Arch. Sci. phys. nat.*, 1905, [iv], 20, 101—110).—The colour of pure water is blue, the green and yellow tints of natural waters are due to foreign admixture. Calcium salts dissolved in water seem to give a green tint, but the author shows that this is due to a fine invisible suspension (probably organic matter and silica) and that with adequate precautions calcium salts have no effect on the colour of water. The brown or yellow colours are due to humus or salts of iron; both these are precipitated, however, if calcium salts are present. The latter, therefore, assist in restoring the natural colour of water and the green tint is often due to a state of stationary equilibrium



between the precipitating effect of the calcium salts and the continuous admixture of humus or ferric salts.

L. M. J.

**Some Properties of the Hydrides of the Metalloids of the First Three Families.** ROBERT DE FORCRAND (*Ann. Chim. Phys.*, 1905, [viii], 5, 289—307. Compare Abstr., 1902, ii, 253, 254, 379, 498, 557; this vol., ii, 310, 372).—The correlation of boiling point, melting point, heat of formation, and specific gravity in the liquid state with the molecular weight of each of the members of these three groups of hydrides is studied and in part exhibited by means of curves. It is shown that in general the difference between the values of any one of these constants for two consecutive hydrides of the same group is proportional to the difference between the molecular weights of the two hydrides and that in each series the volatility and fusibility diminish and the specific gravity and heat of formation increase as the molecular weight augments.

The hydrides of the first members and, to a less extent, those of the last members, of each group show abnormalities. It is pointed out that in the case of the former the abnormality may be due to association, but this explanation does not account for all the facts, and it is more probably due to the peculiar chemical constitution of these hydrides. Observations are already on record of other abnormalities in the behaviour of water, hydrofluoric acid, and ammonia, the three hydrides in question.

T. A. H.

**The Castner Mercury Process of obtaining Chlorine and Alkali.** MAX LE BLANC and CARLO CANTONI (*Zeit. Elektrochem.*, 1905, 11, 609—612).—A description of a laboratory model of the Castner electrolytic cell. Experiments with the model are described in which potassium hydroxide is prepared from potassium chloride with a current efficiency of 90 per cent.

T. E.

**Atomic Weight of Chlorine.** HAROLD B. DIXON and E. C. EDGAR (*Phil. Trans.*, 1905, A, 205, 169—200).—The method adopted, as outlined by the authors, was as follows. Chlorine obtained by electrolysis of fused silver chloride (with purified carbon poles in a Jena glass vessel) was condensed and weighed in a sealed glass bulb; this bulb was attached to an exhausted "combustion globe," and the chlorine was allowed to evaporate slowly into the globe. The hydrogen, prepared by the electrolysis of barium hydroxide, was dried and absorbed by palladium in a weighed vessel. The palladium, on being heated, gave off the hydrogen, which was ignited by a spark and burnt at a jet in the combustion globe previously filled with chlorine. The gases were regulated so as to maintain the hydrogen flame until nearly all the chlorine had combined; then the palladium was allowed to cool, and the hydrogen was turned off just before the flame died out. The hydrogen chloride formed was dissolved by water standing in the globe, which was kept cool with ice. The residual gas in the globe was analysed, and the chlorine remaining in the globe unburnt was determined by breaking a thin glass bulb containing potassium iodide and titrating the liberated iodine by thiosulphate in an atmosphere of

carbon dioxide. In each experiment, about 11 litres each of hydrogen and chlorine were burnt; the volume of chlorine left unburnt was about 2 per cent. of the volume burnt. The chlorine and hydrogen bulbs were counterpoised on the balance by bulbs of the same glass and of nearly the same displacement, and the small weights used were reduced to a vacuum standard. Nine experiments were made, and the mean value obtained for the atomic weight of chlorine is 35.463 ( $O=16$ ), appreciably higher than the value 35.447 calculated by Clarke from the previous determinations, and slightly higher than Stas' value, 35.457.

Incidentally, it was shown that neither gaseous nor liquid chlorine has any appreciable effect on soft glass. J. C. P.

**Chlorine.** DAVID L. CHAPMAN and CHARLES H. BURGESS (*Mem. Manchester Phil. Soc.*, 1905, 49, xiii, 1—3. Compare this vol., ii, 236).—Small quantities of ether, alcohol, and benzene have no effect on the combination of hydrogen and chlorine; they do not give rise to an induction period. Experiments carried out to ascertain which possible chemical compound is immediately active in the induction period caused by the presence of traces of ammonia indicate that this is nitrogen chloride. When the gaseous mixture is exposed to light until the rate of combination is a maximum and is then left for some time in the dark, a second induction period occurs on exposure to light if the water contains traces of organic matter. This is probably due to the action of chlorine on the organic substances in the dark, with the formation of compounds which then prevent the combination of hydrogen and chlorine in the light. The opinion expressed previously that sulphur dioxide behaves similarly to ammonia is not confirmed by further experiments. H. M. D.

**Electrolytic Formation of Chlorates.** FRITZ FOERSTER and ERICH MÜLLER (*Zeit. Elektrochem.*, 1905, 11, 502—503).—The acceleration of the reaction between hypochlorous acid and hypochlorite ion by platinum studied by Sirk (this vol., ii, 381) was observed by the authors previously (*Abstr.*, 1902, ii, 591 and 641). They showed it to be of secondary importance in the formation of chlorates. T. E.

**Theory of Auto-oxidation.** JULIUS MEYER (*J. pr. Chem.*, 1905, [ii], 72, 278—296).—The theories of the mechanism of auto-oxidation held by various authors are reviewed. The one which agrees best with the experimental facts is that auto-oxidation consists of the addition to an unsaturated molecule of a molecule of oxygen, one atom of which functions as quadrivalent. The grouping  $O:O:$  is probably more common and more stable than the union of two quadrivalent oxygen atoms, as amongst the nitrogen compounds the grouping  $N''':N'$  is more common and more stable than the union of two quinquivalent nitrogen atoms. According to this view, hydrogen peroxide, which exists in the unimolecular state only, has the constitution  $O:OH_2$ , whilst water exists in the bimolecular,  $OH_2:OH_2$ , as well as in the unimolecular form (compare Brühl, *Abstr.*, 1896, ii, 163). The peroxides must have corresponding formulæ, for example,

ozone,  $\text{O}:\text{O}:\text{O}$ ; barium oxide,  $\text{O}:\text{O}\text{Ba}$ ; potassium dioxide,  $\text{O}:\text{OK}_2$ ; and sodium hydrogen peroxide,  $\text{O}:\text{OHNa}$  (Tafel, Abstr., 1894, ii, 448).

The several reactions of hydrogen peroxide and of its derivatives are explained by means of, and shown to be in agreement with, the suggested constitutions.

As hydrogen peroxide acts principally as a reducing agent, giving up hydrogen and forming oxygen, the bivalent oxygen atom must be more firmly united to the quadrivalent atom than are the hydrogen atoms.

G. Y.

**Electrical Production of Ozone.** OSCAR KAUSCH (*Chem. Centr.*, 1905, ii, 438; from *Elektrochem. Zeit.*, 1905, 12, 69—74).—An account of the various forms of apparatus devised by Strong, Courtis, Jarnold, and Otto for the preparation of ozone.

P. H.

**Action of Alkali [Hydroxides] on Sulphur.** H. POMERANZ (*Zeit. Farb. Text. Ind.*, 1905, 4, 392—393).—The author supposes that the primary action between alkali hydroxides and sulphur is analogous to that between alkali hydroxides and chlorine in the cold, and takes place according to the equation  $4\text{NaOH} + 2\text{S} = \text{Na}_2\text{S} + \text{Na}_2\text{SO}_2 + 2\text{H}_2\text{O}$  or  $3\text{NaOH} + 2\text{S} = \text{Na}_2\text{S} + \text{NaHSO}_2 + \text{H}_2\text{O}$ . In support of this view, it is found that a mixture of sulphur and sodium hydroxide in the ratio  $2\text{S} : 3\text{NaOH}$  has a similar bleaching action on *p*-nitro-aniline-red to that of sodium hyposulphite. Polysulphide and thio-sulphate are only produced by the further action of the sulphur on the sulphide and hyposulphite. The formula  $\text{H}_2\text{SO}_2$  for the hyposulphites harmonises with the author's observations, but Bernthsen's formula is inadmissible.

H. M. D.

**Polysulphides. III. Periodic Phenomena during the Electrolysis of Polysulphides.** FRIEDRICH W. KÜSTER (*Zeit. anorg. Chem.*, 1905, 46, 113—143).—If a fairly concentrated solution of disodium sulphide is electrolysed between platinum electrodes with an *E.M.F.* of about 2 volts, yellow films due to the formation of polysulphide separate out in the liquid. After a time, sulphur suddenly appears on the surface of the anode, and then rapidly increases in thickness. The *E.M.F.* rises as the thickness of the sulphur increases, until at a certain stage the sulphur film suddenly breaks away; the *E.M.F.* now falls, and the phenomena recur in the same order. This periodicity is similar to that observed by Ostwald during the solution of chromium in hydrochloric acid (Abstr., 1900, ii, 730; 1901, ii, 24), and has been studied quantitatively by means of a modified Ostwald chemograph.

[With K. KOELICHEN.]—The form of the curves which express the periodicity of current strength is very varied.

Apart from the condition of the anode and electrolyte, it is found that the *E.M.F.*, and consequently the current strength, must have a certain magnitude before sulphur separates and the periodicity appears. On the other hand, the *E.M.F.* must not be too great or the deposit of sulphur remains permanently on the anode. The "critical



*E.M.F.* depends on the chemical composition of the electrolyte, its concentration, temperature, and its stillness or otherwise. In solutions of sodium hydrosulphide, no periodic phenomena are observed. In disodium sulphide solutions, the periods begin after about 7 to 8 per cent. of the sulphide has been converted into polysulphide. If the ratio of polysulphide to sulphide in the solution exceeds a certain limit, the fluctuations no longer occur. Increasing concentration of sulphide or rising temperature causes increasing complication in the form of the periodicity curve. The higher the temperature, the greater the current density needed to cause vibrations to appear; the amplitude of the vibrations and the critical *E.M.F.* increase at first with rising temperature and then fall. The form of the curves is largely dependent on the form and surface of the electrodes.

It is suggested that during electrolysis the sulphur liberated at first at the anode is taken up by the sulphur ions of the solution to form polysulphide ions until saturation occurs; sulphur then separates, and the current becomes feeble owing to the resistance of the sulphur. During the time when the current is feeble, the polysulphide ions migrate away from the anode more quickly than they are formed, whilst the monosulphide ions (which can take up sulphur) migrate towards the anode and eventually break down the layer of sulphur.

D. H. J.

**Constitution of Fremy's Sulphazilate and of Pelouze's Nitrosulphate.** ARTHUR HANTZSCH (*Ber.*, 1905, 38, 3079—3082).—A reply to Divers, this vol., ii, 449.

J. J. S.

**Sulphammonium and its Relation to Nitrogen Sulphide.** OTTO RUFF and EMIL GEISEL (*Ber.*, 1905, 38, 2659—2667. Compare Abstr., 1904, ii, 396; Moissan, Abstr., 1901, ii, 234).—Hydrogen sulphide and nitrogen sulphide are formed by the action of sulphur on liquid ammonia according to the equation  $10S + 4NH_3 = 6H_2S + N_4S_4$ . The hydrogen sulphide is completely precipitated as silver sulphide, and the blue colour of the sulphammonium is changed into the orange-red of a solution of nitrogen sulphide in ammonia when silver iodide (12 mols.) is added to sulphur (10 atoms) dissolved in liquid ammonia. The nitrogen sulphide is isolated by evaporating the filtrate, heating the residue at 100° for two hours, and extracting with carbon disulphide. If a current of air is passed through sulphammonium as soon as the liquid ammonia is evaporated, ammonium sulphide volatilises and is detected by means of lead nitrate; the residue contains sulphur and nitrogen sulphide. The reaction is reversible, as, if hydrogen sulphide is condensed over a solution of nitrogen sulphide in ammonia cooled by liquid air in a tube which is sealed and allowed to assume slowly the ordinary temperature, a blue ring is formed at the junction of the two liquids, which rapidly disappears as the hydrogen sulphide is absorbed. On evaporating the ammonia, a residue is obtained consisting of sulphur together with the excess of ammonium sulphide. Sulphammonium is formed also by the action of hydrogen sulphide on nitrogen sulphide in ammonia at -35°

or of ammonia and a limited amount of hydrogen sulphide on lead or mercury dithiodi-imide.

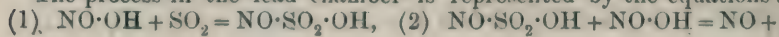
The blue colour of sulphammonium is due most probably to dissolved colloidal sulphur. G. Y.

**Theory of the Lead Chamber Process. III—V. FRITZ RASCHIG** (*Zeit. angew. Chem.*, 1905, 18, 1281—1323. Compare this vol., ii, 23).—A lecture delivered to a joint meeting of the Oberrheinischer Bezirksverein deutscher Chemiker and the Heidelberg Chemischen Gesellschaft. The theory of the lead chamber process is dealt with in great detail and the following conclusions are drawn. Nitric oxide quickly combines with oxygen to form nitrogen trioxide, which then undergoes slow oxidation to form nitric peroxide. In the atmosphere of the lead chamber, nitric oxide is oxidised to nitrous acid in about three seconds; the further oxidation to the peroxide requires about five minutes for its completion. The particular oxide of nitrogen which in the lead chamber combines with sulphurous acid is the trioxide, a conclusion which is also borne out by the behaviour of nitric peroxide and nitrogen trioxide respectively towards sulphur dioxide in the presence of water; nitric peroxide dissolves in water to form a mixture of nitric and nitrous acids, whilst only the latter acid unites with sulphur dioxide. Nitrogen trioxide, on the other hand, unites directly with sulphurous acid. Nitrogen trioxide is readily soluble in concentrated sulphuric acid; it is not so readily soluble either in aqueous sodium hydroxide or in water. When nitrogen trioxide is dissolved in water, it is partially decomposed into nitric oxide and nitric peroxide, the former being eliminated as a gas and the latter dissolving to form a mixture of nitrite and nitrate. On the other hand, nitric peroxide is readily soluble in aqueous sodium hydroxide to form a mixture of nitrite and nitrate; it is soluble with difficulty in sulphuric acid, when it undergoes decomposition with the evolution of some oxygen.

The compound obtained by dissolving nitrogen trioxide in sulphuric acid is not a nitrosylsulphuric acid,  $\text{O}:\text{N}\cdot\text{O}\cdot\text{SO}_2\cdot\text{OH}$ , as is generally assumed, but is a nitrosulphonic acid,  $\text{O}_2\text{N}\cdot\text{SO}_2\cdot\text{OH}$ , the sulphur atom being attached directly to the nitrogen atom. When this compound is reduced, the acid  $\text{O}:\text{N}(\text{OH})\cdot\text{SO}_2\cdot\text{OH}$  is produced. The latter acid forms a blue solution with concentrated sulphuric acid; with more dilute sulphuric acid, it forms a red coloration, which becomes violet when copper sulphate is added; it is very unstable, the products of its decomposition being nitric oxide and sulphuric acid. With copper and iron respectively, it forms compounds of the nature of salts, the solutions of which in concentrated sulphuric acid do not give off nitric oxide on being agitated.

In the Glover tower, nitrous acid is first formed from nitrosulphonic acid; nitroso- and nitroso-sulphonic acids are next formed, and finally nitric oxide and sulphuric acid. Nitric oxide is further oxidised to nitrous acid, which combines with sulphurous acid to form nitric oxide and sulphuric acid.

The process in the lead chamber is represented by the equations:



$\text{NO}(\text{OH})\cdot\text{SO}_2\cdot\text{OH}$ , (3)  $\text{NO}(\text{OH})\cdot\text{SO}_2\cdot\text{OH} = \text{NO} + \text{H}_2\text{SO}_4$ , (4)  $2\text{NO} + \text{O} + \text{H}_2\text{O} = 2\text{NO}\cdot\text{OH}$ .  
A. McK.

**The Contact Process of Manufacturing Sulphuric Acid.** RICHARD LUCAS (*Zeit. Elektrochem.*, 1905, 11, 457—461).—Bodländer and Köppen (Abstr., 1903, ii, 639) studied the equilibrium between sulphur dioxide and oxygen by the manometric method; the author (this vol., ii, 396), having found that pure platinum does not absorb oxygen, has completed the work by making measurements at temperatures above  $600^\circ$ . His results are summarised in the following table, in which  $K = [\text{SO}_2]^2[\text{O}_2]/[\text{SO}_3]^2$ .

Temperature.	K.
500°	$0.1646 \times 10^{-5}$
600	$0.2720 \times 10^{-4}$
700	$0.2525 \times 10^{-3}$
800	$0.1548 \times 10^{-2}$

T. E.

**Colloidalising Action of Caoutchouc on Selenium.** RUDOLF DITMAR (*Chem. Centr.*, 1905, ii, 741; from *Sitzungsber. Akad. Wiss. Wien*, 1905).—When a solution of isinglass to which a few drops of gold chloride solution have been added is warmed, a blood-red coloration makes its appearance. On addition of a larger quantity of gold chloride, the solution assumes a violet and then a black colour. When finely-divided metallic gold is used instead of the chloride, the gold does not assume the colloidal form. On the other hand, caoutchouc mixed and warmed with finely-divided black, amorphous selenium assumes the dark red colour of colloidal selenium. This is the first observed case of the direct transmission of the colloidal condition to an element under the contact influence of a colloid. The observation supports the view that the sulphur in vulcanised caoutchouc is present in the colloidal form. Attempts to vulcanise caoutchouc with selenium were unsuccessful.

H. M. D.

**Chemistry of the Tellurates.** EDGAR BURTON HUTCHINS, jun. (*J. Amer. Chem. Soc.*, 1905, 27, 1157—1183).—When silver oxide is treated with slight excess of a solution of telluric acid, silver tellurate,  $\text{Ag}_2\text{TeO}_4\cdot 2\text{H}_2\text{O}$ , is obtained as a heavy, granular powder which differs in physical properties from the compound described by Berzelius (*Ann. Phys. Chem.*, 1834, [ii], 32, 577). This salt can be obtained in a crystalline form by the slow evaporation of a mixture of silver acetate and telluric acid solutions or by the action of silver nitrate on a concentrated solution of potassium tellurate containing a little free acetic acid. The crystals belong to the orthorhombic system [ $a:b:c = 0.722:1:2.107$ ]. When this salt is left in contact with a solution of a silver salt, the basic tellurate,  $3\text{Ag}_2\text{O}\cdot 2\text{TeO}_3\cdot 3\text{H}_2\text{O}$ , is obtained in the form of red crystals.

The crystalline compound described by Oppenheim (*J. pr. Chem.*, 1857, 71, 266) as a double salt of silver nitrate and tellurate is the



salt  $\text{Ag}_2\text{TeO}_4 \cdot 2\text{H}_2\text{O}$ . The acid tellurates of silver described by Berzelius (*loc. cit.*) could not be obtained. In addition to the basic tellurates of silver,  $3\text{Ag}_2\text{O} \cdot 2\text{TeO}_3$  and  $3\text{Ag}_2\text{O} \cdot \text{TeO}_3$ , described by Berzelius, another compound,  $3\text{Ag}_2\text{O} \cdot 2\text{TeO}_3 \cdot 3\text{H}_2\text{O}$ , has been isolated, which crystallises in red, transparent, monoclinic prisms.

Crystalline potassium tellurate,  $\text{K}_2\text{TeO}_4 \cdot 5\text{H}_2\text{O}$ , cannot be obtained by treating potassium carbonate with telluric acid, as stated by Berzelius (*loc. cit.*), since telluric acid is unable to replace the whole of the carbonic acid in an equivalent quantity of potassium carbonate. The crystals can, however, be obtained by the slow evaporation of a solution of the salt prepared from potassium hydroxide and telluric acid or of the solution formed by the interaction of silver tellurate and potassium bromide. The existence of the salt  $\text{K}_2\text{TeO}_4 \cdot 2\text{H}_2\text{O}$ , described by Retgers (*Abstr.*, 1893, ii, 161), is confirmed. The acid potassium tellurates,  $\text{KHTeO}_4$  and  $\text{K}_2\text{O} \cdot 4\text{TeO}_3$ , described by Berzelius (*loc. cit.*), crystallise as  $\text{K}_2\text{O} \cdot 2\text{TeO}_3 \cdot 4\text{H}_2\text{O}$  and  $\text{K}_2\text{O} \cdot 4\text{TeO}_3 \cdot 4\text{H}_2\text{O}$  respectively. When a solution of potassium carbonate (1 mol.) is added to a solution of telluric acid (4 mols.) and the mixture is evaporated, the salt  $\text{K}_2\text{O} \cdot 3\text{TeO}_3 \cdot 5\text{H}_2\text{O}$  is obtained as a white, granular precipitate.

When mercurous tellurate (Berzelius, *loc. cit.*) or mercurous nitrate is treated with a cold concentrated solution of telluric acid, *mercurous hydrogen tellurate*,  $\text{HgHTeO}_4 \cdot 3\text{H}_2\text{O}$ , is obtained, which forms triclinic crystals. Two *mercuric tellurates*,  $\text{Hg}_3\text{TeO}_6$  and  $\text{HgTeO}_4 \cdot 2\text{H}_2\text{O}$ , have been prepared; the former is obtained in amber-coloured crystals of the cubic system, whilst the latter is white and crystallises in the rhombic system; an amorphous *mercuric tellurate*,  $\text{HgTeO}_4$ , is described, which is obtained as a light yellow powder.

The compound obtained by the action of potassium tellurate on copper nitrate is not copper tellurate,  $\text{CuTeO}_4$ , as stated by Berzelius, but is the *orthotellurate*,  $\text{Cu}_3\text{TeO}_6$ . The corresponding zinc salt,  $\text{Zn}_3\text{TeO}_6$ , is also described. Attempts were made to prepare a gold tellurate, but without success.

Hot concentrated solutions of telluric acid attack mercury, silver, lead, tin, arsenic, antimony, bismuth, nickel, zinc, aluminium, and cadmium.

There are no well authenticated cases of isomorphism between sulphates and tellurates or between selenates and tellurates. E. G.

**Determination of the Atomic Weight of Nitrogen; Gravitimetric Analysis of Nitrous Oxide.** PHILIPPE A. GUYE and STEFAN BOGDAN (*J. Chim. Phys.*, 1905, 3, 537—561).—A more detailed account of work already published (*Abstr.*, 1904, ii, 575; see also *Abstr.*, 1904, ii, 475, 812; this vol., ii, 506). L. M. J.

**Preparation of Oxides of Nitrogen by High Tension Discharges in Air.** OTTO SCHEUER (*Zeit. Elektrochem.*, 1905, 11, 565—580).—An arc discharge between metal poles is used, the current being furnished either by a Ruhmkorff coil or by a step-up transformer. A large number of different forms of electrode is described. The general results are that in order to obtain good yields the air must

pass through the flame and be at once cooled and removed; the shape, size, and arrangement of the apparatus is of the greatest importance. The kind of current used (pressure, strength of current, and frequency) is important; a large current is unfavourable. The material of the electrodes is of little importance. Ammonia is formed in addition to the oxides of nitrogen when moist air is employed. T. E.

**Electrolytic Preparation of Nitrite from Nitrate, especially at Silver Cathodes.** ERICH MÜLLER and FRITZ SPITZER (*Zeit. Elektrochem.*, 1905, 11, 509—515).—In continuation of the experiments of Müller and Weber (*Abstr.*, 1904, ii, 116) it is shown that cathodes of silver behave in very much the same way as those of copper. The difference between the potentials of cathodes of spongy silver in solutions of alkali nitrate and nitrite is, however, much greater than is the case with copper, and it is therefore possible by means of a silver cathode to reduce the nitrate to nitrite much more completely before any considerable formation of ammonia takes place. Gold is quite unsuitable, the potential of a gold cathode being almost the same in a solution of nitrate as in a solution of nitrite. T. E.

**Phosphorus Pentasulphide.** ALFRED STOCK and KURT THIEL (*Ber.*, 1905, 38, 2719—2730).—Phosphorus pentasulphide, prepared by heating at 120—130° for 12 hours a solution of yellow phosphorus and sulphur in carbon disulphide containing a trace of iodine, has the appearance of flowers of sulphur and melts at 275—276°. Phosphorus pentasulphide exists in at least two modifications; the ordinary form has the melting point quoted and differs from the others in its more sparing solubility in carbon disulphide. The two forms cannot be separated by fractional crystallisation from carbon disulphide. The form which is more readily soluble in carbon disulphide does not exhibit a sharp melting point. Ebullioscopic determinations of the molecular weight of the ordinary form in carbon disulphide shows it to have the formula  $P_4S_{10}$ . When similar determinations are made with the form which is more readily soluble in carbon disulphide, the values do not agree with the formula  $P_4S_{10}$ , the molecular weight being smaller than that in accordance with this formula; the product is probably a mixture. A. McK.

**Constituents of Manchester Soot.** EDMUND KNECHT (*Mem. Manchester Phil. Soc.*, 1905, 49, xiv, 1—10).—All the samples examined showed a strongly acid reaction due to presence of free sulphuric acid, which amounted to about 1 per cent. on the average. The methods of examination consisted in extracting with water, boiling dilute sulphuric acid, sodium hydroxide, and with benzene. The amounts of constituents estimated directly are:

Ammonium sulphate .....	10.7 per cent.
Mineral matter (ash).....	19.6    "
Acid constituents .....	10.9    "
Benzene extract (hydrocarbons) .....	13.0    "
Difference (carbon ?).....	45.8    "

A sample of London soot was found to contain considerably less extractive matter, the benzene extract only amounting to 1.3 per cent. A sample from Prague, produced by the incomplete combustion of lignite coal, gave an aqueous extract neutral to litmus; the acid constituents amounted to 2 per cent. and the benzene extract was as low as 0.2 per cent.

H. M. D.

**Action of Sulphur on Carbon Tetrabromide.** A. VON BARTAL (*Ber.*, 1905, 38, 3067—3071).—When carbon tetrabromide and flowers of sulphur are heated together, a liquid distils over when the bath is at 180—195°, and an indigo-blue residue consisting of the compound  $C_9Br_4S_4$ , previously described by Hell and Urech (*Abstr.*, 1883, 907), together with free carbon, is left in the flask. The blue compound is purified by extraction with ether, alcohol, and carbon disulphide and subsequent solution in phenol and precipitation with alcohol. The yield is only 1.5—2 grams per 100 of tetrabromide.

The distillate contains carbon disulphide, bromine, and Hell and Urech's carbothiohexabromide,  $C_2Br_6S_3$ . Sulphur bromide is also probably formed.

J. J. S.

**New Method of Preparation of Neon, Krypton, and Xenon.** SIEGFRIED VALENTINER and R. SCHMIDT (*Sitzungsber. K. Akad. Wiss. Berlin*, 1905, 38, 816—820).—The apparatus consists of a cylindrical tube of 100 c.c. capacity, the volume of which can be altered by admitting mercury from below; it is connected by means of capillary tubes provided with stopcocks with (a) a small reservoir containing cocoanut charcoal, (b) a vessel in which the neon is to be collected, (c) a pipette containing argon free from chemically active gases, and (d) the mercury pump. The inert gaseous mixture is admitted into the apparatus and the charcoal reservoir cooled in liquid air. After 10—15 minutes, the stopcock on the tube leading to the charcoal reservoir is closed, and, by allowing mercury to enter the cylindrical tube, the unabsorbed neon is forced into the reservoir. The neon can be freed from helium by bringing the gas into contact with fresh charcoal cooled in liquid air and pumping off the gas which remains unabsorbed. The gas which escapes from the charcoal when the reservoir is allowed to return to the ordinary temperature is pure neon.

For the separation of krypton and neon, the apparatus is provided with two charcoal tubes, one of which is cooled to  $-120^\circ$  after the inert gaseous mixture has been introduced into the apparatus. The whole of the krypton and xenon and some argon are absorbed, but the latter is completely removed when connection is established with the second reservoir cooled in liquid air. On allowing the temperature to rise from  $-120^\circ$  to  $-80^\circ$ , pure krypton is evolved. At  $-15-0^\circ$ , xenon mixed with some krypton escapes. To remove the krypton from this mixture, it is first absorbed by charcoal cooled in liquid air. Connection having been made with the second charcoal reservoir cooled to  $-180^\circ$ , the greater portion of the absorbed gas is removed by warming the first reservoir to  $20^\circ$ . The remaining gas, which escapes on heating gently with the free flame, consists of pure xenon.

H. M. D.



**Action of Weak Acids on Metallic Chlorides.** ALFRED BENRATH (*J. pr. Chem.*, 1905, [ii], 72, 238—243).—The author has investigated the composition of the salts obtained on treating chlorides of the alkali metals and of the alkaline earths with sulphuric, oxalic, tartaric, and phosphoric acids. The products obtained from the interaction in aqueous solution are not necessarily the same as those from alcoholic solution. As a rule, the less soluble salt is precipitated, but if this is the salt of the weaker acid, unless its solubility is extremely small, its precipitation may be prevented in aqueous solution by the solvent action of the stronger acid. In alcoholic solution, the differences between the extents to which the different acids are dissociated are much smaller than in aqueous solution, the solvent power of the stronger acid is diminished greatly, and the salts are precipitated strictly according to their solubilities (compare also this vol., i, 734).

G. Y.

**Complex Compounds of Carbonic Acid with Heavy Metals.** ROBERT LUTHER and B. KRŠNĀVI (*Zeit. anorg. Chem.*, 1905, 46, 170—173).—A large number of heavy metals form complex anions with alkali hydrogen carbonates. The compounds formed have been long known as "double compounds" and are formed by treating the hydroxide or carbonate of the metal with alkali hydrogen carbonate or by adding an excess of alkali hydrogen carbonate to the solution of the metallic salt. The precipitate at first formed dissolves in excess of the precipitant, and from this fact alone it might have been inferred that there is formation of complex undissociated salts.

The intensely coloured solutions of the carbonate derivatives of bivalent copper, ferric iron, and uranyl diffuse through parchment and are therefore not colloidal; the metal always migrates to the anode.

Preliminary measurements of *E.M.F.* show that the copper complex probably consists of one cupric ion and two  $\text{HCO}_3$  ions.

In addition to the above metals, magnesium, chromium, cobalt, and nickel appear to some extent to yield complex anions with alkali hydrogen carbonates (compare W. C. Reynolds, *Trans.*, 1898, 73, 262).

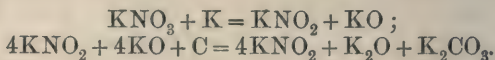
D. H. J.

**Electrolysis of the Fused Nitrates of Potassium, Sodium, and Lithium.** ALEXIS BOGORODSKY (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 703—759).—The author has determined the products formed during the electrolysis under different voltages of the fused nitrates of potassium, sodium, and lithium at temperatures near their solidification points, the cathodes used being of aluminium and graphite and the anodes of platinum. The anode gases consist entirely of oxygen and nitrogen peroxide, and the solid products are mixtures of the oxides and nitrites of the metals. When potassium nitrate or sodium nitrate is electrolysed at a voltage varying between 5 and 35, the fused salt around the cathode turns yellow or orange-red, a yellow precipitate which is formed dissolving in the fused salt. This colour is supposed by the author to be due to the formation of higher peroxides of the metals. With fused lithium nitrate, the orange-red colour appears at the anode, and, if the *E.M.F.* exceeds 6 volts, metallic lithium is deposited on the cathode. The gas evolved at the anode is a mixture

of 1 mol. of oxygen with 2 mols. of nitrogen peroxide ( $O_2 + 2NO_2$ ), but the ratio of alkali oxide to alkali nitrite in the liquid surrounding the cathode varies with the cathode material, as shown in the following table :

	$K_2O : KNO_2$	$Na_2O : NaNO_2$	$Li_2O : LiNO_2$
Graphite cathode.....	1 : 2	1 : 1.6	1 : 1
Aluminium cathode ...	1 : 1	1 : 0.8	1 : 1

From these ratios the author concludes that when a graphite cathode is used the lithium separated at the cathode is oxidised to  $Li_2O$ , whilst with potassium the oxidation proceeds as far as the formation of  $KO$ , which then undergoes further change :



With aluminium cathodes, only the first of these changes occurs. Sodium nitrate occupies a position intermediate between those of the other two nitrates.

T. H. P

**Decomposition and Preservation of Sodium Hyposulphite as Anhydrous Powder and in Aqueous Solution.** AUGUSTE LUMIÈRE, LOUIS LUMIÈRE, and ALPHONSE SEYEWETZ (*Bull. Soc. chim.*, 1905, [iii], 33, 931—944. Compare Bernthsen, this vol., ii, 240. Bazlen, *ibid.*).—When exposed in a thin layer to the action of moist air, powdered anhydrous sodium hyposulphite is completely decomposed in seven days, but is practically stable in a closed vessel or in dry air, the slow changes observed, 10 and 4 per cent. loss of sodium hyposulphite respectively in two months, being due to admission of moisture in removing the daily samples.

Solutions of sodium hyposulphite in boiled distilled water in closed vessels decompose at rates varying with the concentration ; 25, 10, and 3 per cent. solutions are decomposed in three, eleven, and thirty-seven days respectively. The rate of change is accelerated by rise of temperature or by exposure of the solution to the air ; in the latter case, the relative stabilities are reversed, a 3 per cent. solution decomposing entirely in one, a 20 per cent. solution in two days.

Chloral and quinol, the latter when present in such small quantities as are found to protect sodium sulphite from oxidation, have no influence on the stability of sodium hyposulphite solutions. The influence of some alkaline substances, aldehydes, and other substances used in photographic developers on a 3 per cent. solution of sodium hyposulphite is exemplified in the following table (p. 707). The figures in brackets after the number of days are the percentages of hyposulphite unchanged at the end of the experiment ; in other cases, decomposition is complete at the end of the number of days given.

The decomposition of sodium hyposulphite takes place according to the equations :  $3Na_2S_2O_4 = 2Na_2S_2O_3 + Na_2S_2O_6$  ;  $Na_2S_2O_4 + O = Na_2SO_3 + SO_2$ , sodium hydrogen sulphite being formed in aqueous solution. The chief product of the reaction is the sulphite.

Substance added.	Grams per litre added.	No. of days.
NaOH .....	10—100	5
Na <sub>2</sub> CO <sub>3</sub> .....	2	4
.....	100	11
K <sub>2</sub> CO <sub>3</sub> .....	5—200	8
NH <sub>3</sub> (c.c.) ... ..	10—200	4
Trisodium phos- phate ...	5	3
„ „	50	6
„ „	100	24
Acetone + Na <sub>2</sub> SO <sub>3</sub> .	5+15	5
„ „	20+60	7
„ „	40+120	4
Aniline .....	100	4
Methylamine .....	10	4 (0.9)
Sodium hydrogen phosphate	50	5
„ „	100	7

Substance added.	Grams per litre added.	No. of days.
Sodium silicate (syrup)	25	5
„ „	100	23 (0.9)
Acetaldehyde (c.c.)	30	28 (5.9)
„ „	100	21
Formaldehyde „	50	28 (14.9)
„ „	200	28 (8.1)
Trioxymethylene + Na <sub>2</sub> SO <sub>3</sub>	10+1	28 (26.5)
„ „	50+3	28 (24.4)
Hexamethylene- tetramine .....	100	28 (17.5)
Benzaldehyde .....	25	4
„ „	50	19
Acetone .....	50	2
„ „	100	5
„ „	200	6

G. Y.

**Rubidium Fluorides.** HANS EGGELING and JULIUS MEYER (*Zeit. anorg. Chem.*, 1905, 46, 174—176).—*Rubidium fluoride*, RbF, forms a crystalline mass, very soluble in water; freezing-point measurements prove it to be unimolecular and almost completely dissociated. It forms many double salts. *Rubidium silicofluoride*, Rb<sub>2</sub>SiF<sub>6</sub>, is a heavy, white powder insoluble in water. *Hydrogen rubidium difluoride*, HRbF<sub>2</sub>, is a crystalline, very hygroscopic mass; the aqueous solution probably contains the ions Rb' and HF<sub>2</sub>'. Fairly stable salts of the formulæ H<sub>2</sub>RbF<sub>3</sub> and H<sub>3</sub>RbF<sub>4</sub> also exist.

D. H. J.

**Preparation of Ammonium Dichromate.** R. SEGALLE (*Chem. Centr.*, 1905, ii, 444—445; from 41 *Jahresh. d. gr. or. Oberrealschule Czernowitz*, 1904—1905).—Potassium or sodium dichromate (1 mol.) is heated in aqueous solution with ammonium chloride (2 mols.) until the liquid assumes a deep garnet-red colour. After evaporating to half its bulk, the solution deposits in one or two days deep garnet-red, needle-shaped crystals of ammonium dichromate, which at a red heat burst into flame with evolution of ammonia and water vapour. Ammonium dichromate, which is very soluble in water, may be separated from potassium dichromate and ammonium chloride by precipitating it from solution by means of alcohol, but some of it is reduced in the process.

[With LANGER.]—Reichard's method of estimating chromic acid by means of arsenious oxide (compare Abstr., 1900, ii, 691) is modified by reducing the ammonium dichromate in concentrated acid solution in the cold, diluting with water, adding excess of sodium hydrogen carbonate, and titrating back with iodine, keeping a stream of carbon dioxide bubbling through the solution.

P. H.

**Action of Silver Nitrate and Thallous Nitrate on Certain Natural Silicates.** GEORGE STEIGER (*Bull. U.S. Geol. Surv.*, 1905, No. 262, 75—90); FRANK W. CLARKE (*Zeit. anorg. Chem.*, 1905, 46, 197—207).—Clarke and Steiger (Abstr., 1903, ii, 380) have shown



that the alkali and alkaline earth metals of many minerals may be replaced by ammonium, and Steiger (Abstr., 1902, ii, 561) has obtained silver derivatives of analcite and chabazite. In the experiments now described, the finely-powdered minerals were mixed with various amounts of silver nitrate or thallous nitrate and heated in sealed tubes at temperatures somewhat above the melting points of the nitrates; the fused masses were extracted with water and the residues analysed. The products obtained are crystalline, and contain heavy metals in place of the alkali or alkaline earth metals of the original minerals.

Analcite ( $\text{NaAlSi}_2\text{O}_6 \cdot \text{H}_2\text{O}$ ) yields the product  $\text{AgAlSi}_2\text{O}_6 \cdot \text{H}_2\text{O}$ , which is snow-white and optically isotropic like the original mineral. This silver-analcite is decomposed by nitric acid, but not by sodium carbonate solution; when digested with sodium thiosulphate solution, it is reconverted into the original sodium compound. The thallium derivative of both analcite and leucite ( $\text{KAlSi}_2\text{O}_6$ ) approximates to  $\text{TlAlSi}_2\text{O}_6$  in composition. Analcite, when heated in a sealed tube with a lead nitrate solution, has part of the sodium replaced by lead.

Similar results were obtained with several other zeolites (thomsonite, chabazite, stilbite, natrolite, scolecite, and mesolite), the replacement of the alkali or alkaline earth metal by heavy metals being more or less complete in each case. Pectolite is attacked by silver nitrate, but the product is not simple in composition; elæolite and ægirite are only slightly acted on.

L. J. S.

**Preparation of Metallic Calcium in the Laboratory.** PAUL WÖHLER (*Zeit. Elektrochem.*, 1905, 11, 612—618).—Calcium chloride (100 parts) and calcium fluoride (17 parts) are fused together in an iron crucible 20 cm. wide and 11 cm. deep. An anode of graphite or amorphous carbon and a cathode of iron rod, 8 mm. in diameter, are used. The distance between the electrodes should be less than their distance from the wall of the crucible, otherwise the latter acts as an intermediate conductor and is perforated by the action of the chlorine at the place where it acts as anode, and gives rise to the formation of a calcium-iron alloy at the place where it acts as cathode. The temperature of the electrolyte must lie between its own melting point ( $660^\circ$ ) and that of calcium ( $800^\circ$ ). It deteriorates in time, becoming viscid, probably owing to the formation of hydrated oxychloride; hydrogen is then liberated at the cathode and the yield decreases. The cathodic current density may vary from 50 to 250 amperes per sq. cm. The anodic current density should not exceed about 5.6 amperes per sq. cm. Chlorine is not liberated during the electrolysis; the author supposes that it combines with the carbon of the anode. The cathode touches the surface of the electrolyte and is raised as the calcium forms, so that a stick of solid metal is produced. With a current of 40 amperes, from 33 to 38 volts are required. The current efficiency is over 80 per cent. The metal contained a minute trace of iron, but was otherwise pure; its specific gravity was 1.51.

T. E.

**Solubilities in Mixed Solvents. III. Solubility of Calcium Hydroxide in Aqueous Glycerol.** WALTER HERZ and M. KNOCH (*Zeit. anorg. Chem.*, 1905, 46, 193—196. Compare Abstr., 1904, ii, 709; this vol., ii, 510).—The solubility of calcium hydroxide in aqueous glycerol increases rapidly with increasing percentage of glycerol. It is suggested that for the authors' experiments on solubilities in mixed solvents the expression  $(S+A)W/(S+A+W)$  has a constant value, where  $S$  is the number of grams of substance in 100 c.c. of solution,  $A$  the corresponding quantity of acetone or glycerol, and  $W$  the quantity of water, but the experimental material is not yet sufficient to establish the constancy.

D. H. J.

**Compounds of Haloid Salts of Metals with Hydroxylamine.** G. N. ANTONOFF (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 476—483).—The author has prepared and analysed the following double salts, which were obtained crystalline by deposition from aqueous alcoholic solution:  $\text{MgCl}_2, 2\text{NH}_2\cdot\text{OH}, 2\text{H}_2\text{O}$ ;  $2\text{CaCl}_2, 3\text{NH}_2\cdot\text{OH}, 6\text{H}_2\text{O}$ ;  $2\text{CaCl}_2, 5\text{NH}_2\cdot\text{OH}, 4\text{H}_2\text{O}$ ;  $\text{CaCl}_2, 2\text{NH}_2\cdot\text{OH}, 2\text{H}_2\text{O}$ ;  $\text{CaCl}_2, 2\text{NH}_2\cdot\text{OH}, \text{H}_2\text{O}$ ;  $\text{CaCl}_2, 2\text{NH}_2\cdot\text{OH}$ ;  $4\text{CaCl}_2, \text{NH}_2\cdot\text{OH}, 20\text{H}_2\text{O}$ ;  $2\text{SrCl}_2, 5\text{NH}_2\cdot\text{OH}, 2\text{H}_2\text{O}$ ;  $2\text{SrCl}_2, 9\text{NH}_2\cdot\text{OH}, 3\text{HCl}, \text{H}_2\text{O}$ ;  $\text{BaCl}_2, \text{NH}_2\cdot\text{OH}, 2\text{H}_2\text{O}$ .

Aqueous solutions saturated at  $20^\circ$  contain: about 1 per cent. of  $\text{ZnCl}_2, 2\text{NH}_2\cdot\text{OH}$ ; about 1 per cent. of  $\text{CdCl}_2, 2\text{NH}_2\cdot\text{OH}$ ; 44.4 per cent. of  $\text{MgCl}_2, 2\text{NH}_2\cdot\text{OH}, 2\text{H}_2\text{O}$  or 56.6 per cent. of  $\text{CaCl}_2, 2\text{NH}_2\cdot\text{OH}, \text{H}_2\text{O}$ .

T. H. P.

**"Setting" and "Hardening" of Cement.** EDUARD JORDIS (*Bull. Soc. chim.*, 1905, [iii], 33, 1029—1032).—The present position of the chemistry of this subject is discussed; the conclusions are indicated which may legitimately be drawn from the facts so far established experimentally, and it is pointed out that the principal problems have only been solved approximately.

T. A. H.

**Changes of Colour caused by the Action of Certain Rays on Glass.** CHARLES E. RUEGER (*J. Amer. Chem. Soc.*, 1905, 27, 1206. Compare Avery, this vol., ii, 589).—Colourless glass which is allowed to remain for some years exposed to the sun's rays in the northern part of the Butte District, Montana, U.S.A., becomes violet. This district contains large ore deposits, in which manganese dioxide is a prominent constituent. It is suggested that the colour may possibly be due to the proximity of the manganese ore, but is more probably due to manganese originally present in the glass. In any case, it is proved that the production of this violet coloration is not confined to the tropics.

E. G.

**Physical Properties of Glass as Functions of the Chemical Composition.** EBERHARD ZSCHIMMER (*Zeit. Elektrochem.*, 1905, 11, 629—638).—A *résumé* of the researches which have been made at the glass-works of Messrs. Schott, in Jena. The greater part of the results has been published already. From unpublished experiments

of Schott and Abbe, it is shown that the addition of the oxides of lithium, zinc, barium, or lead to boron trioxide glass increases the refractive index. The increase is not proportional to the quantities added, the ratio decreasing for the first two oxides and increasing for the last two as the quantity added increases. The same behaviour is observed when the oxides of sodium, zinc, barium, or lead are added to quartz glass. The oxide with the greater molecular weight gives the greater increase in refractive index. The addition of boron trioxide to a potassium silicate glass first increases the refractive index and then diminishes it. The author's own experiments on the hygroscopic qualities of glass show that all glasses which contain alkalis absorb water from steam at about  $80^{\circ}$ ; lime, zinc oxide, baryta, and especially boron trioxide diminish the tendency to absorb water.

T. E.

**Atomic Weights of Carbon and Glucinum.** CHARLES L. PARSONS (*J. Amer. Chem. Soc.*, 1905, 27, 1204—1206; *Zeit. anorg. Chem.*, 1905, 46, 215—216).—It is pointed out that the determinations of the equivalent of glucinum (*Abstr.*, 1904, ii, 658) having been made with two compounds containing the same elements, the atomic weight of glucinum could, from the data obtained, be calculated independently of the carbon, and that the atomic weight of carbon could also be obtained independently of that of glucinum. Calculating by means of simultaneous equations, the atomic weight of glucinum was found to be 9.112 as compared with 9.113 previously given, whilst the atomic weight of carbon was found to be 12.007.

E. G.

**Alloys of Magnesium with Tin and with Lead.** NICOLAI S. KURNAKOFF and N. J. STEPANOFF (*Zeit. anorg. Chem.*, 1905, 46, 177—192).—A complete fusion diagram has been constructed for the alloys, and the results have been confirmed by a microchemical investigation.

*Magnesium-tin Alloys* (compare Grube, this vol., ii, 636).—The fusion curve shows eutectic points at 8.55 atomic per cent. of magnesium and  $203.5^{\circ}$ , and at 88 atomic per cent. of magnesium and  $580^{\circ}$ ; there is a maximum or dystectic point at  $795^{\circ}$ , showing the formation of the compound  $Mg_2Sn$ , which thus has a melting point above that of magnesium ( $650^{\circ}$ ). Magnesium stannide,  $Mg_2Sn$ , forms crystalline aggregates which show well-marked octahedral cleavage, so that tin-magnesium alloys are brittle owing to its presence. Its sp. gr. is 3.591 at  $20^{\circ}/4^{\circ}$ . Its hardness, 3.5, is greater than that of the constituents. The streak is grey. The atomic lowering of the freezing point of tin by magnesium agrees with the value calculated from van't Hoff's formula, and shows the absence of solid solutions.

*Magnesium-lead Alloys.*—The fusion curve shows eutectic points at 15.73 atomic per cent. of magnesium and  $253^{\circ}$ , and at 80 atomic per cent. of magnesium and  $475^{\circ}$ ; there is a dystectic point at  $550^{\circ}$ , marking the existence of the compound magnesium plumbide,  $Mg_2Pb$  (compare Grube, this vol., ii, 320).

D. H. J.



**Relation of Lead Iodide to Water and Oxygen.** M. A. SCHTSCHERBAKOFF (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 682—699).—The electrochemical investigation of fused lead iodide by Czepinski (Abstr., 1899, ii, 267), Helfenstein (Abstr., 1900, ii, 383), Garrard (Abstr., 1901, ii, 54), and Auerbach (Abstr., 1901, ii, 590) shows that this salt exhibits abnormal behaviour as regards Faraday's law, and as regards the relation between the polarisation *E.M.F.* and heat of formation, &c. The author finds that these abnormalities are due to the fact that fused lead iodide absorbs oxygen from the air forming an oxyiodide, the amount of which may correspond with more than 30 per cent. of the iodide. This action proceeds with increased rapidity in presence of metallic lead. When heated in a current of steam, lead iodide also undergoes change according to the equation  $\text{PbI}_2 + \text{H}_2\text{O} = \text{PbI} \cdot \text{OH} + \text{HI}$ ; boiling water has a similar, although slower, action. In a current of carbon dioxide, lead iodide is stable and can be sublimed without change. T. H. P.

**Relation of Lead Iodide to Water and Oxygen.** ALEXIS BOGORODSKY (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 699—702. Compare preceding abstract).—The author considers the formation of insoluble basic compounds by hydrolytic decomposition of salts in solution as due to polymerisation changes. The phenomenon is discussed in reference to the following six factors: (1) the affinity between the simple molecules of the dissolved substance—its tendency to polymerise; (2) the tendency of water to polymerise; (3) and (4) the affinity between the two products of hydrolysis and water; (5) and (6) the polymeric force of the hydrolytic products. T. H. P.

**A New Cause of Dissociation of Mercuric Chloride.** HENRI VITTENET and CHENU (*Bull. Soc. chim.*, 1905, [iii], 33, 944—945. Compare this vol., ii, 35).—It is shown that the amount of precipitate obtained on adding a solution of mercuric and ammonium chlorides to various natural waters is in each case proportional to the temporary hardness of the water, and that no precipitate is obtained if the water is boiled before addition of the reagents. G. Y.

**Isolation of Terbium.** GEORGES URBAIN (*Compt. rend.*, 1905, 141, 521—523).—The author has separated 7 grams of the oxide of the rare element  $\text{Z}_3$  (compare Lecoq de Boisbaudran, Abstr., 1896, ii, 249; Demarçay, Abstr., 1900, ii, 656; Urbain, this vol., ii, 35) from all traces of gadolinium by fractional crystallisation of the double nitrates of the rare earths and of nickel, and, finally, by fractional precipitation with ammonia. The element thus isolated, to which the name *terbium* should be restricted, exhibits an absorption band  $\lambda = 488$ ; a solution of its chloride gives the beautiful green fluorescent spectrum of Lecoq de Boisbaudran's  $\text{Z}_3$  (compare Abstr., 1886, 666); the pure oxide does not exhibit phosphorescence, but when mixed with gadolinium oxide it gives the green phosphorescence of Crookes' G whilst alumina containing only 0.5 per cent. of terbia gives a magnificent white phosphorescence. The atomic weight of terbium, determined by estimating the water in the hydrated sulphate, is 159.2 ( $\text{O} = 16$ ); the oxide is

brown or black, according as it is prepared from the oxalate or sulphate by calcination. The salts of terbium are colourless, and are slightly more soluble than the corresponding salts of gadolinium.

M. A. W.

**Preparation of Metallic Aluminium.** HEINRICH F. D. SCHWAHN (D.R.-P. 160286).—Aluminium may be prepared by the action of reducing gases on aluminium sulphide. A more convenient method is that of heating porous aluminium sulphate (prepared by calcining crystallised aluminium sulphate with a little sodium chloride and breaking up the mass) at 800—900° in a stream of carbon monoxide or other reducing gas containing 5 per cent. of carbon disulphide. Porous aluminium oxide or a mixture of aluminium sulphate with charcoal may be employed in place of the porous sulphate. A vertical graphite furnace is used.

C. H. D.

**Alloys of Copper and Aluminium.** LÉON GUILLET (*Rev. de Métallurgie*, 1905, 2, 567—588).—The freezing point curve of alloys of copper and aluminium shows two maxima corresponding with the compounds  $\text{AlCu}_3$  and  $\text{Al}_2\text{Cu}$  respectively. The existence of a compound  $\text{AlCu}$  is also indicated. The micrographic examination of the alloys shows seven constituents,  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ ,  $\epsilon$ ,  $\eta$ , and  $H$ . The constituent  $\alpha$  is a solid solution of aluminium in copper containing from 0 to 8 per cent. of aluminium. The constituents  $\beta$  and  $\gamma$  consist chiefly of the compound  $\text{AlCu}_3$ , the former being found in slowly cooled alloys and the latter in specimens quenched above 525°. The solid solution  $\delta$  is intermediate in composition between  $\text{AlCu}_3$  and  $\text{AlCu}$ ;  $\epsilon$  seems to be pure  $\text{AlCu}$  and  $\eta$  to be pure  $\text{Al}_2\text{Cu}$ .  $H$  is either pure aluminium or a solid solution containing a very small percentage of copper. The influence of quenching from different temperatures on the physical properties and micro-structure is described.

Alloys consisting only of the solution  $\alpha$  (aluminium bronzes) are malleable and ductile; the presence of  $\beta$  causes hardness and brittleness, 11 per cent. of aluminium being the limiting composition for industrially valuable alloys.

C. H. D.

**A New Isomeric Modification of Aluminium Hydroxide.** DONATO TOMMASI (*Chem. Centr.*, 1905, ii, 605; from *Rev. gén. chim. pure appl.*, [vii], 8, 246—247).—After about three months in contact with water, ordinary aluminium hydroxide, prepared by precipitation from aluminium salt solutions with ammonia, changes into a new  $\delta$ -modification,  $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ , which is easily soluble in concentrated sulphuric acid, but resembles ignited aluminium hydroxide in its slight solubility in hydrochloric, nitric, or acetic acids or in aqueous alkali hydroxides. It does not form an oxychloride with aluminium chloride. If the oxychlorides,  $2(\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}) \cdot 3\text{Al}_2\text{Cl}_6$  and  $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O} \cdot 4\text{Al}_2\text{Cl}_6$ , which are formed by the action of aluminium on cupric chloride in 30 and 8 per cent. solutions respectively are boiled with aluminium until cessation of the evolution of hydrogen, the oxychloride,  $6(\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}) \cdot \text{Al}_2\text{Cl}_6 \cdot 12\text{H}_2\text{O}$ , is formed in nacreous leaflets. On adding concentrated sulphuric acid or certain salts to the aqueous

solution of this, it coagulates with formation of  $\delta$ -aluminium hydroxide. G. Y.

**"Aluminium Carbonicum."** A. GAWALOWSKI (*Chem. Centr.*, 1905, ii, 743—744; from *Pharm. Post*, 1905, 38, 405).—The aluminium carbonate previously prepared by the author (*Chem. Centr.*, 1905, i, 1584) is not the normal carbonate; it contains 40—45 per cent.  $\text{Al}_2\text{O}_3$ , 8—9 per cent.  $\text{CO}_2$ , and water which is in different states of combination. H. M. D.

**Plasticity of Clays.** FRANK F. GROUT (*J. Amer. Chem. Soc.*, 1905, 27, 1037—1049).—It is pointed out that the property of plasticity involves two factors, namely, strength and the amount of deformation possible before crumbling. In the experiments described, the strength was determined by finding the weight required to force a Vicat needle of 7 sq. cm. section into the clay to a depth of 3 cm. in half a minute. The deformation, or amount of possible flow, was determined by measuring the increase in the area of the head of a cylinder of the moist clay, 5 cm. long and 2 cm. in diameter, when the cylinder was compressed to the point of fracture. The product of these two factors was regarded as the measure of plasticity at the particular stage of wetness of the clay. As the mass dried, a maximum plasticity was observed when the clay contained a certain definite proportion of water.

By employing this method, attempts have been made to ascertain the causes of plasticity and have led to the following conclusions. Plasticity is not much affected by the presence of a small proportion of sand, but when the grains of sand are sufficiently numerous to come into contact with one another, both the strength and the amount of flow are diminished. It was found that on addition of 0.08 per cent. of agar-agar, the plasticity of two clays was increased from 7 and 11 to 11 and 15 respectively, whilst it required an amount of alumina cream (calculated as  $\text{Al}_2\text{O}_3$ ) equal to 3 per cent. of the weight of the clay to increase the plasticity to the same extent. Plasticity is also increased by the fineness of the clay and by the presence of plane surfaces (small plates) in the mass, which increase both the amount of possible flow and the strength. The increase in plasticity by weathering is attributed chiefly to mechanical action, but may be due to some extent to addition of colloidal substances by the action of bacteria. It is concluded that molecular attraction is the chief cause of the high degree of plasticity of clays. E. G.

**Composition of a Cannon Ball from the Moat of the Bastille.** A. PORLIER (*Rev. de Métallurgie*, 1905, 2, 793—794).—A cannon ball, one of a number discovered in the former moat of the Bastille, was found to be entirely compact and metallic in appearance, but to give a greenish-yellow fracture. The sp. gr. was only 4.854. Analysis showed it to contain Fe 72.0, C 5.9, Si 0.25, Mn 0.75, O 17.45,  $\text{H}_2\text{O}$  2.9 per cent. On microscopical examination, the original structure of white cast iron was found to be perfectly preserved, the cementite being brilliant and intact, whilst the pearlite had been



replaced by ferric oxide. The replacement had thus been completed by diffusion to a depth of 5 cm., the radius of the ball being 10 cm., in a century or less. The high carbon content is due to a part of the iron having diffused outwards into the surrounding earthy crust.

C. H. D.

**Colloidal Ferric Hydroxide. III. Influence of Various Salts on the Coagulation.** A. V. DUMANSKY (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 502—507. Compare this vol., ii, 37 and 393).—Colloidal ferric hydroxide solutions are coagulated by aqueous solutions of potassium, barium, silver, cupric, manganese, or lead nitrate, cupric or ammonium chloride, sodium carbonate or magnesium sulphate, and these solutions undergo an increase in their electrical conductivity on mixing with the colloidal liquid. On the other hand, solutions of mercurous, mercuric, or aluminium nitrate, mercuric acetate, or ferric chloride, which effect no coagulation of colloidal ferric hydroxide solutions, have their conductivity diminished on being mixed with the latter. From this behaviour, the author concludes that coagulation of colloidal ferric hydroxide is only produced by those salts which are less soluble in the colloidal solution than in water.

T. H. P.

**Iron Sulphides and the Purification of Coal Gas from Hydrogen Sulphide.** L. GEDEL (*Chem. Centr.*, 1905, ii, 445—447; from *J. Gasbel.*, 1905, 48, 400—407).—(1) Iron heated at 450—500° with excess of sulphur forms ferric disulphide,  $\text{FeS}_2$ ; this substance loses sulphur on heating to 700°, giving  $\text{Fe}_7\text{S}_8$ ; heated to above 700°, it is converted into ferrous sulphide,  $\text{FeS}$ . (2) Excess of freshly-prepared ammonium sulphide added to a solution of ferric chloride produces iron sesquisulphide, which, with hydrochloric acid, decomposes according to the equation  $\text{Fe}_2\text{S}_3 + 4\text{HCl} = 2\text{FeCl}_2 + 2\text{H}_2\text{S} + \text{S}$ , and is oxidised by moist air as follows:  $\text{Fe}_2\text{S}_3 + 3\text{O} = \text{Fe}_2\text{O}_3 + 3\text{S}$ . (3) If ferric chloride is treated with ammonium sulphide in sufficient quantity to allow the solution still to remain acid by virtue of the hydrolysis of the iron salt, sulphur is precipitated and a black colour is developed. The product of this reaction has, before drying, the composition  $2\text{FeS} + \text{S}$ ; if, however, it is dried above 100°, it contains some disulphide formed as follows:  $2\text{FeS} + \text{S} = \text{FeS}_2 + \text{FeS}$ . If sufficient ammonium sulphide is added to render the ferric chloride solution alkaline, the dried precipitate contains chiefly the sesquisulphide together with small quantities of ferrous sulphide, sulphur, and ferric disulphide. (4) Ferrous sulphide added to ammonium polysulphide produces iron sesquisulphide. (5) A small amount of ammonium sulphide added to an alkaline solution of an iron salt, obtained by adding ammonia to ferric chloride containing tartaric acid, produces iron sesquisulphide. (6) Hydrogen sulphide acts on dried ferric hydroxide,  $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ , in the presence of hydrochloric acid to form ferrous sulphide, sulphur, and ferric disulphide. (7) Hydrogen sulphide, mixed with a small quantity of ammonia, converts ferric hydroxide into the sesquisulphide. (8) The former product, exposed to the air after the completion of the oxidation, contains the disulphide unchanged; the latter, on the other hand, is completely oxidised to ferric oxide and

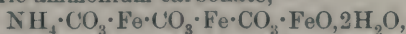
sulphur; in each case a small amount of ferric sulphate is also formed, the amount being independent of the presence of moisture, but increasing with rise of temperature. (9) The admixture of air with hydrogen sulphide containing traces of hydrogen chloride exerts no influence on the formation of ferric disulphide. (10) Gas purifiers contain the sesquisulphide, but not the mono- or di-sulphides of iron.

In the purification of coal gas, the action may be expressed by the equation  $\text{Fe}_2(\text{OH})_6 + 3\text{H}_2\text{S} = \text{Fe}_2\text{S}_3 + 6\text{H}_2\text{O}$ . The formation of the disulphide is prevented by the presence in the gas of traces of ammonia. The sulphide  $\text{Fe}_7\text{S}_8$  behaves towards hydrochloric acid like a compound of the formula  $6\text{FeS}, \text{FeS}_2$ , giving the disulphide with evolution of hydrogen sulphide

P. H.

**New Class of Iron Compounds.** OTTO HAUSER (*Ber.*, 1905, 38, 2707—2710).—The precipitates formed on adding ammonium carbonate to solutions of ferrous or of ferric salts are soluble in an excess of the reagent. The ferric solution thus prepared is a blood-red liquid from which the iron is precipitated by hydrogen sulphide, or by reagents which react with carbonates, or by boiling alkali hydroxides, but not by potassium ferrocyanide, whereas Prussian blue dissolves in aqueous ammonium carbonate to form a violet-red solution. The ferric ammonium carbonate solution is stable in a closed vessel for several weeks, but deposits ferric hydroxide on evaporation.

The white ferrous precipitate is less easily soluble in excess of ammonium carbonate, forming a colourless solution which, on treatment with hydrogen peroxide or on free exposure to air, rapidly becomes brown, but when oxidised by a limited quantity of air it deposits a basic ferroso-ferric ammonium carbonate,



which forms stellate aggregates of small, doubly refracting, green prisms, and on exposure to air becomes olive-green and finally brown, owing to formation of ferric hydroxide. It dissolves with evolution of carbon dioxide in dilute acids to form yellowish-green solutions, and when treated with alkali hydroxides yields ammonia and a black, strongly magnetic ferroso-ferric oxide.

The olive-green powder formed on partial oxidation of the basic salt contains ferrous and ferric iron in the proportion 1 : 1. G. Y.

**Iron and Chromium Nitrides.** EMIL BAUR and GERARDUS L. VOERMAN (*Zeit. physikal. Chem.*, 1905, 52, 467—478).—Under no conditions could a direct combination of iron and nitrogen be observed. The tension of iron nitride is too great to be determined; at temperatures between  $500^\circ$  and  $600^\circ$ , it is certainly greater than 15 atmospheres. In these circumstances, the authors' study of the equilibrium  $\text{iron} + \text{ammonia} \rightleftharpoons \text{iron nitride} + \text{hydrogen}$  does not throw much light on the dissociation of ammonia, the calculation of which was one of the chief objects of the investigation.

The tension of chromium nitride at high temperatures has been measured, but it has been observed that the dissociation does not proceed until a definite dissociation pressure has been reached, and then cease; on the contrary, the dissociation pressure exhibits a

continuous, if slow, increase, and the view is adopted that chromium and chromium nitride form, not two constant phases, but one variable phase (compare Muthmann and Baur, *Abstr.*, 1903, ii, 213). In these circumstances, the tensions of chromium nitride determined by the author are only approximate; at  $800^{\circ}$ , for example, the tension is about 100 mm. Chromium nitride is much more stable than iron nitride, and is not reduced in a current of hydrogen, even at a pressure of 13 atmospheres. It is noteworthy that chromium is very efficient as a catalytic agent in the decomposition of ammonia, whilst it has no effect whatever in promoting the synthesis of ammonia; it is possibly a one-sided catalytic agent. J. C. P.

**Solubilities of the Isomeric Chromic Chlorides.** H. W. BAKHUIS ROOZEBOOM and J. OLIE, jun. (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, 8, 66—70).—Since the isomeric chromic chlorides may be estimated in each other's presence (see Werner and Gubser, *Abstr.*, 1901, ii, 453), and require in solution much more time to get into equilibrium with each other than is necessary for the establishment of equilibrium between solid and solution, it is possible to study the change of solubility resulting from the gradual transformation which goes on in the solution.

The final condition of chromic chloride solutions of various concentrations at  $25^{\circ}$  has been determined, and it is found that both the green and the violet salts lead to the same condition of equilibrium. In weak solutions, the chromic chloride at the point of equilibrium occurs almost exclusively in the violet modification. As the concentration increases, the equilibrium shifts more and more in favour of the green modification.

The solubilities also of the green and violet salts have been determined at  $25^{\circ}$ . The solubility in each case increases as time goes on owing to the transformation green  $\rightarrow$  violet, or violet  $\rightarrow$  green, as the case may be. When the two solubility lines are represented on the same diagram as the equilibrium curve, it is seen that the latter intersects the solubility line for the green salt, hence the violet chromic chloride cannot be definitely in equilibrium at  $25^{\circ}$  with any solution; that is, the green salt is the stable modification at that temperature. The precipitation of the violet salt by passing hydrogen chloride into solutions of the green salt previously heated to  $100^{\circ}$  is possible, because at the latter temperature the equilibrium curve cuts the solubility line for the violet salt; the change violet  $\rightarrow$  green in solution is slow enough to allow of the precipitation of the violet salt.

J. C. P.

**Perchromates.** KARL A. HOFMANN and H. HIENDLMAIER (*Ber.*, 1905, 38, 3059—3066. Compare *Abstr.*, 1904, ii, 410, 737; Riesenfeld, Wohlers, and Kutsch, this vol., ii, 461).—Wiede's compound,  $\text{CrO}_4(\text{NH}_3)_3$  (*Abstr.*, 1898, ii, 28), is obtained when 10 per cent. aqueous ammonium hydroxide is saturated at  $0^{\circ}$  with crystallised ammonium dichromate, 30 per cent. hydrogen peroxide added to the clear solution, and the mixture kept for 6—12 hours. The large, brown crystals which separate are freed from a red, crystalline powder by allowing the temperature to rise to  $10$ — $15^{\circ}$ . Its properties are those of an



ammine and not of an ammonium salt, and it is represented on Werner's co-ordinate system as  $(\text{NH}_3)_3\text{Cr} \begin{array}{c} \diagup \text{O} \\ \diagdown \text{O}_2 \end{array}$ . An isomeride ( $\beta$ -compound)

is formed when a 20 per cent. solution of ammonia is saturated at  $0^\circ$ , first with ammonium dichromate and then with ammonia, and finally 30 per cent. hydrogen peroxide added. After some 12 hours, quadratic plates are obtained showing strong pleochroism from yellowish-brown to dirty purple. Extinction with crossed Nicols occurs parallel to the diagonals. The compound resembles its isomeride in all its more important physical and chemical properties, but differs slightly in solubility and rate of decomposition. The three ammonia groups are not removed by treatment with 40 per cent. acetic acid. Wiede's compound,  $\text{NH}_4\text{CrO}_5 \cdot \text{H}_2\text{O}_2$  (Abstr., 1898, ii, 295), is readily obtained when saturated ammonium chromate solution (4 c.c.) is mixed with water (3 c.c.) and excess of crystallised ammonium nitrate at  $0^\circ$  and 30 per cent. hydrogen peroxide (4 c.c.) added to the clear solution at a low temperature.

Ice-cold 20 per cent. ammonia solution transforms it partly into the  $\beta$ -compound, and the addition of small amounts of water causes the evolution of five equivalents of oxygen and the formation of ammonium dichromate.

J. J. S.

**Halogen Compounds of Molybdenum and Tungsten.** ARTHUR ROSENHEIM and HANS J. BRAUN (*Zeit. anorg. Chem.*, 1905, 46, 311—322).—The molybdenum required for the preparation of the chlorides was obtained in good yield and free from air-bubbles by a modification of the Goldschmidt process, the reaction being moderated by the addition of a flux of 50 parts of calcium fluoride for every 100 parts of molybdenum trioxide and 38 parts of aluminium, and the metal allowed to agglomerate by keeping the mass in a liquid condition for some time after the reaction.

Insoluble molybdenum trichloride,  $\text{MoCl}_3$ , prepared according to the directions of Blomstrand and of Liechti and Kempe, has the appearance of red phosphorus. It slowly decomposes in the air with evolution of hydrogen chloride. It is quite insoluble in water and in most other solvents. It is slightly soluble in nitrobenzene, but not sufficiently to allow a molecular weight determination to be made.

By the action of a stream of gaseous ammonia on it at  $340^\circ$ , a black substance,  $\text{Mo}_2(\text{NH}_2)_3\text{Cl}_3$ , is formed, which is insoluble in dilute acids and in water, and evolves ammonia when heated with soda-lime. By employing a temperature of  $760^\circ$  instead of  $340^\circ$ , molybdenum nitride,  $\text{Mo}_3\text{N}_2$ , is obtained as a grey, metallic powder, the properties of which have already been described by Uhrlaub. Molybdenum trichloride under the action of a solution of ammonia develops considerable heat and yields a black, easily oxidisable substance of the formula  $\text{MoNH}_4\text{O}_4$ .

In contact with liquefied ammonia, it gives a brown product of the formula  $\text{Mo}_2(\text{NH}_2)_3\text{Cl}_3 \cdot 10\text{NH}_3$ , which evolves ammonia in the air and finally leaves a residue of  $\text{Mo}_2(\text{NH}_2)_3\text{Cl}_3$ .

Insoluble molybdenum tribromide is obtained similarly to the tri-

chloride; it forms black needles which may be sublimed. By the action of ammonia gas even at a low temperature it is reduced to metallic molybdenum.

In view of the close resemblance between insoluble molybdenum chloride and insoluble chromium chloride, an attempt was made to obtain a soluble form of chromium trichloride by the catalytic action of molybdenum dichloride, zinc chloride, &c. The attempt was unsuccessful, but the chloride has since been obtained in solution by Chilesotti, who electrolysed a hydrochloric acid solution of molybdic acid. On adding potassium fluoride to the soluble chloride, a bright violet, crystalline precipitate of the salt  $\text{KMoF}_4 \cdot \text{H}_2\text{O}$  is obtained, which is insoluble in water, but is gradually decomposed by it. Similarly the salt  $(\text{NH}_4)\text{MoF}_4 \cdot \text{H}_2\text{O}$  is obtained. The filtrate from the latter gives, on evaporation over sulphuric acid, violet crystals having the composition  $(\text{NH}_4)_3\text{Mo}_2\text{F}_9 \cdot 2\text{H}_2\text{O}$ . Molybdenum sodium fluoride was formed, but was not obtained pure.

Soluble molybdenum tribromide is obtained in a similar way to the chloride; on addition of ammonium bromide, it gives a solution from which dark red, rhombic crystals of the composition  $(\text{NH}_4)_2\text{MoBr}_5 \cdot \text{H}_2\text{O}$  are obtained by evaporation.  
D. H. J.

**Reduction of Thorium Oxide by Boron and Silicon.** EDGAR WEDEKIND and K. FETZER (*Chem. Zeit.*, 1905, 29, 1031—1032).—An intimate mixture of 10 grams of thorium oxide with 3.5 grams of crystalline silicon was heated in a magnesite crucible for seven minutes by a current of 100—110 amperes. The resulting mass, which has a metallic and crystalline appearance, is being investigated. With boron, a grey, micro-crystalline mass was obtained, which was not completely fused on further heating.  
P. H.

**Presence of Bismuth in Pyrites from Agordo.** ARNALDO PIUTTI and E. STOPPANI (*Gazzetta*, 1905, 35, ii, 29—32).—Pyrites from the mines of Agordo contains traces of bismuth. A method for its extraction on the large scale is described.  
T. H. P.

**Hardness of Hammered Tantalum.** WERNER VON BOLTON (*Zeit. Elektrochem.*, 1905, 11, 503—504).—The tantalum used in the experiments on hardness previously described (this vol., ii, 258) contained traces of oxide which very considerably increase its hardness. It also appears that the diamond is not suitable for drilling ductile metals. Further experiments show that the metal can be filed with a specially hard file, the edge of a very hard chisel is spoiled at each blow, a very hard drill lubricated with turpentine will perforate 1 mm. of the metal in seven to ten minutes, a steel point, hardened in water, scratches the metal, but soon becomes blunt. It appears, therefore, that tantalum combines the hardness of the best and most carefully hardened steel with sufficient ductility to allow it to be rolled or hammered.

T. E.

**Tantalum and Hydrogen.** M. VON PIRANI (*Zeit. Elektrochem.*, 1905, 11, 555—558).—When pure tantalum is heated in very care-

fully purified hydrogen, it absorbs a considerable quantity of the gas. At a red heat the metal takes up 0.3 per cent. of its weight, at a yellow heat 0.4 per cent. (in four to six hours), and this quantity is not increased by heating to whiteness. The volume of hydrogen absorbed is 740 times that of the metal. The wire, after taking up the hydrogen, is white with metallic lustre, crystalline, and so brittle that it may be powdered in a mortar. The electrical resistance is increased 1.7 to 2.1 times and its temperature-coefficient is decreased from 0.3 to 0.1 per cent. per degree. When the metal containing hydrogen is heated to redness in a vacuum, it loses about three-fourths of the hydrogen fairly readily. The remainder is only completely expelled by fusing the metal. The small, firmly combined residue of hydrogen (about 0.1 per cent. of the weight of the metal) is sufficient to make it brittle and to give it high electrical resistance.

The hydrogen compound is also formed when tantalum pentachloride is heated in a current of hydrogen in a hard glass tube containing a red hot platinum wire; the hydride is deposited on the hot wire.

T. E.

**Double Fluorides of Tantalum.** CLARENCE W. BALKE (*J. Amer. Chem. Soc.*, 1905, 27, 1140—1157).—The tantalic oxide used in this investigation was obtained from the columbite of South Dakota. Potassium tantalum fluoride obtained by the addition of potassium fluoride to a solution of the mixed metallic oxides was purified by repeated crystallisation from water acidified with hydrofluoric acid, and was afterwards heated with concentrated sulphuric acid in order to remove silica. The product was boiled repeatedly with water and the white oxide thus obtained was well washed with water. The following double salts were prepared and analysed.

*Tantalum lithium fluoride*,  $\text{LiF}, \text{TaF}_5, 2\text{H}_2\text{O}$ , forms monoclinic crystals [ $a:b:c = 0.5703:1:1.6235$ ;  $\beta = 87^\circ 46'$ ].

The tantalum sodium fluorides,  $3\text{NaF}, \text{TaF}_5$  and  $2\text{NaF}, \text{TaF}_5, \text{H}_2\text{O}$ , have been prepared by Marignac (*Ann. Chim. Phys.*, 1866, [iv], 9, 247). One gram of the former salt was found to dissolve in 20.5—20.9 parts of water at  $25^\circ$ ; it crystallises in rhombic prisms [ $a:b:c = 0.6017:1:0.2799$ ]. The salt  $2\text{NaF}, \text{TaF}_5, \text{H}_2\text{O}$  crystallises in thin plates; the mother liquor from this salt slowly deposits the double salt,  $\text{NaF}, \text{TaF}_5$ , which crystallises in lustrous cubes of the isometric system.

The existence of the potassium salts,  $2\text{KF}, \text{TaF}_5$  and  $2\text{KF}, \text{TaO}_2\text{F}_3, \text{H}_2\text{O}$ , was confirmed.

The rubidium salt,  $2\text{RbF}, \text{TaF}_5$ , was prepared, and evidence was obtained of the existence of another tantalum rubidium fluoride richer in tantalum.

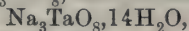
*Tantalum caesium fluoride*,  $\text{CsF}, \text{TaF}_5$ , forms rhombohedral crystals [ $c = 1.0467$ ]; the salt  $2\text{CsF}, \text{TaF}_5$  crystallises in small needles.

*Tantalum pyridine fluoride*,  $3(\text{C}_5\text{H}_5\text{N}, \text{HF}), 2\text{TaF}_5, 2\text{H}_2\text{O}$ , forms hexagonal crystals [ $c = 1.6259$ ]; by dissolving this salt in strong hydrofluoric acid, the salt  $\text{C}_5\text{H}_5\text{N}, \text{HF}, \text{TaF}_5$  can be obtained, which crystallises in long, slender needles. Crystalline salts were also obtained with methylamine, ethylamine, triethylamine, and quinoline.



In addition to the salt  $2\text{NH}_4\text{F}\cdot\text{TaF}_5$ , described by Marignac, evidence was obtained of the existence of other tantalum ammonium fluorides.

Pertantalates can be readily prepared by the action of hydrogen peroxide on solutions of the corresponding tantalates; in this way, potassium pertantalate,  $\text{K}_3\text{TaO}_8$ , and sodium pertantalate,



were prepared (compare Melikoff and Pissarjewsky, *Abstr.*, 1899, ii, 491). E. G.

**Melting Point of Gold and Expansion of Some Gases at High Temperatures.** II. ADRIEN JAQUEROD and F. LOUIS PERROT (*Arch. Sci. phys. nat.*, 1905, 20, 128—151. See this vol., ii, 627).—The results of the determinations of the melting point of gold with the silica gas thermometer previously described are recorded. The values are: nitrogen ( $T_0=272\cdot85$ ),  $1066\cdot9^\circ$ ,  $1067\cdot4^\circ$ ,  $1067\cdot5^\circ$ ,  $1067\cdot2^\circ$ ; air ( $T_0=272\cdot85$ ),  $1067\cdot0^\circ$ ,  $1067\cdot4^\circ$ ; carbon dioxide ( $T_0=271\cdot96$ ),  $1066\cdot1^\circ$ ,  $1066\cdot3^\circ$ ,  $1066\cdot7^\circ$ ; oxygen ( $T_0=272\cdot66$ ),  $1066\cdot7^\circ$ ,  $1066\cdot7^\circ$ ,  $1066\cdot8^\circ$ ,  $1067\cdot1^\circ$ ; carbon monoxide ( $T_0=272\cdot85$ ),  $1067\cdot05^\circ$ . It is impossible to obtain determinations with hydrogen or with helium, as it is found that both gases diffuse through silica at high temperatures. In the case of hydrogen, it is shown that this diffusion, although absent at the ordinary temperature, becomes evident at  $200^\circ$ , whilst with helium it is more marked and would probably be perceptible at  $100^\circ$ . A determination of the melting point of gold with a porcelain nitrogen thermometer gave the value  $1063\cdot15^\circ$ , but it is found that this substance also is useless for helium or hydrogen, which diffuse through at the temperature necessary. L. M. J.

**Platinum Compounds.** MAURICE BLONDEL (*Ann. Chim. Phys.*, 1905, [viii], 6, 81—144).—Platinic hydroxide,  $\text{PtO}_2\cdot 4\text{H}_2\text{O}$ , when freshly prepared by Fremy's method, is readily soluble in dilute acids or alkalis to form normal salts, and hence in this state is probably represented by the formula  $\text{Pt}(\text{OH})_4\cdot 2\text{H}_2\text{O}$ , two of the hydroxyl groups being acidic and two basic. When dried by exposure to air, or even when allowed to remain for some time in contact with water, the hydroxide darkens in colour and becomes insoluble in dilute acids, and is then probably represented by the formula  $\text{H}_2\text{Pt}(\text{OH})_6$ , and is a compound belonging to the chloroplatinic acid series. When heated, platinic hydroxide loses 2 mols. of water at  $100^\circ$ , forming Dübeneiner's oxide, which is soluble only with difficulty in acids and alkalis, and a third mol. at  $120^\circ$  (compare Wöhler, *Abstr.*, 1904, ii, 44).

Platinic hydroxide dissolves in alkalis to form normal or orthoplatinates of the type  $\text{Pt}(\text{OH})_4\cdot 2\text{M}'\text{OH}$ , where  $\text{M}'$  is an alkali metal. These are readily soluble in water, but when heated at  $100^\circ$  become insoluble and less readily attacked by acids, and are then probably represented by the typical formula  $\text{M}_2'\text{Pt}(\text{OH})_6$  (compare Bellucci, *Abstr.*, 1904, ii, 180). A solution of the normal sodium platinate after standing for some days becomes gelatinous owing to the separation of Weiss and Dübeneiner's platinate,  $\text{Na}_2\text{O}(\text{PtO}_2)_3\cdot 6\text{H}_2\text{O}$ , and when dialysed for several days a solution of sodium metaplatinate,  $\text{Na}_2\text{O}(\text{PtO}_2)_5\cdot 9\text{H}_2\text{O}$ , is obtained. The metaplatinate can be reconverted

into orthoplatinate by the addition of alkali. Both platينات yield precipitates of platonic hydroxide on addition of acetic acid.

When platonic hydroxide is mixed with excess of dilute hydrochloric acid, it dissolves, forming a solution of the normal chloride,  $\text{Pt}(\text{OH})_4 \cdot 2\text{HCl}$ . This gives no precipitate on addition of a solution of a potassium salt, and yields platonic hydroxide in an amorphous form when diluted with water, and in a crystalline form when dialysed. When kept, the normal chloride in this solution rapidly passes into chloroplatinic acid.

When a solution of chloroplatinic acid is saturated with platonic hydroxide and the liquid is dialysed, there is eventually formed a product which coagulates when gently warmed or on the addition of a trace of an alkali salt. The coagulate so formed is reddish-brown and has the composition represented by the formula  $(\text{PtO}_2)_5 \cdot 2\text{HCl} \cdot 9\text{H}_2\text{O}$ , is slowly dissolved by hydrochloric acid, forming chloroplatinic acid, and is converted by boiling water into anhydrous *metaplatinic acid*,  $(\text{PtO}_2)_5 \cdot 5\text{H}_2\text{O}$ . These compounds present some analogy with the ferric compounds similarly prepared by Béchamp (*Ann. Chim. Phys.*, 1859, 296) and the metastannyl derivatives obtained by Engel (*Abstr.*, 1897, ii, 376).

When a solution of silver nitrate is added to a saturated solution of platonic hydroxide in chloroplatinic acid, a precipitate of the salt  $(\text{PtO}_2)_4 \cdot 3\text{HCl} \cdot \text{AgCl} \cdot 4\text{H}_2\text{O}$  is formed; this, when washed with water, decomposes, yielding a solution of a platonic compound and a precipitate of silver chloride. The treatment may be repeated several times and a series of platonic compounds containing decreasing amounts of chlorine obtained.

Platonic hydroxide dissolves slowly in sulphuric acid, diluted with its own volume of water at  $0^\circ$ , and from the solution heavy, orange-yellow, microscopic needles of *normal platonic sulphate*,  $\text{PtO}_2 \cdot \text{SO}_3 \cdot 4\text{H}_2\text{O}$ , separate. This loses  $3\text{H}_2\text{O}$  at  $100^\circ$ , and is converted into the compound  $\text{H}_2\text{PtO}_2 \cdot \text{SO}_4$ , which may be regarded as a derivative of platinimono-sulphuric acid,  $\text{H}_2\text{Pt}(\text{OH})_4 \cdot \text{SO}_4$ .

Platonic sulphate dissolved in sulphuric acid is reduced by oxalic acid to *sesquioxyplatinisulphuric acid*, which may be represented by the constitutional formula  $\text{Pt}_2(\text{OH})_6(\text{SO}_3)_4(\text{OH})_2 \cdot 8\frac{1}{2}\text{H}_2\text{O}$ . It crystallises in pale yellow, triclinic prisms [ $a:b:c = 1.6236:1:0.5492$ ;  $\alpha = 88^\circ 55'$ ,  $\beta = 90^\circ 29'$ ,  $\gamma = 101^\circ 53'$ ] and gradually loses water when dried under reduced pressure over sulphuric acid, forming the stable, less hydrated acid  $\text{Pt}_2\text{O}_3 \cdot 3\text{SO}_3 \cdot \text{H}_2\text{SO}_4 \cdot 4\text{H}_2\text{O}$ . Aqueous solutions of sesquioxyplatinisulphuric acid give no precipitate with barium chloride at first, but do so after standing for some time. The acid is dibasic. Excess of alkali precipitates from it a condensed form of hydrated *platinum sesquioxide* (compare Dudley, *Abstr.*, 1902, ii, 564), and excess of hydrochloric acid produces a mixture of platinous and platonic chlorides. The *sodium*, *potassium*, and *barium* salts are crystalline. This acid and its salts present some analogies with the complex chromium and iron compounds obtained by Recoura (*Abstr.*, 1895, ii, 501, and 1903, ii, 600).

When potassium platinoso-oxalate is oxidised with hydrogen peroxide, it is converted into *potassium platinioxalate*,  $\text{K}_2\text{PtO}(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O}$ , which

crystallises in large, amber-yellow, rhombic tablets, is excessively soluble in water, and detonates when heated. The *free acid*,  $\text{H}_2\text{PtO}(\text{C}_2\text{O}_4)_2 \cdot 5\text{H}_2\text{O}$ , is obtained by decomposing the silver salt with hydrochloric acid; it crystallises in large, amber-coloured tablets and detonates violently when heated.

The copper-coloured platinoso-oxalates are shown to contain platoso-oxalic acid and not to be isomeric with the yellow platinoso-oxalates or decomposition products of these, as has been supposed (compare Werner, *Abstr.*, 1896, i, 465; Vezes, *Abstr.*, 1899, i, 572).

A method for the estimation of platinum in platinoso-oxalates by the use of potassium permanganate is described in the original.

T. A. H.

**The Oxides of Palladium.** LOTHAR WÖHLER and JAMES KÖNIG (*Zeit. anorg. Chem.*, 1905, 46, 323—349).—Of the four oxides described in the literature only two, namely,  $\text{PdO}_2$  and  $\text{PdO}$ , are found to exist.

Palladium dioxide prepared by double decomposition is more or less impure; it is best obtained by the action of ozone on palladium salts or by the anodic electrolytic oxidation of palladium salts in nearly neutral solution, and with nitric acid as the cathodic depolariser. It is thus obtained as a dark brown product with varying amounts of combined water; the dissociation of the more highly hydrated substance is probably exothermic. When dried over sulphuric acid, its formula is approximately  $\text{PdO}_2 \cdot 2\text{H}_2\text{O}$ . It is unstable, and in contact even with cold water decomposes slowly into monoxide and oxygen. The dry substance is more stable, but at about  $200^\circ$  it is completely decomposed. Its behaviour to acids and alkalis varies with the time which has elapsed since its preparation. The substance when dried over sulphuric acid dissolves readily in nitric acid and fairly readily in sulphuric acid. When freshly precipitated, it is insoluble in dilute sodium hydroxide. It is a strong oxidising agent, and reduces hydrogen peroxide both in acid and alkaline solution.

Palladium monoxide,  $\text{PdO}$ , is best obtained by boiling a faintly acid solution of palladium nitrate with water. It separates with varying amounts of combined water, and the colour varies correspondingly from yellowish-brown to black. Dried over sulphuric acid it forms black, shining grains. At  $100^\circ$ , it is blackish-brown, but still contains 8 per cent. of water, which it still retains at  $200^\circ$  and even at  $500$ — $600^\circ$ . It is not until it is heated to a temperature of  $800$ — $840^\circ$  in oxygen that the quite anhydrous green monoxide is obtained. Above this temperature, the anhydrous oxide decomposes. Precipitated in the cold, the hydrated monoxide is soluble in dilute acids and in excess of alkali; precipitated hot and then boiled up in the liquid, it is no longer completely soluble even in boiling concentrated alkali hydroxides. Dried at  $100^\circ$ , it is insoluble in acetic acid and nearly insoluble in sulphuric or nitric acid. The completely anhydrous substance is scarcely soluble in boiling hydrochloric acid or in *aqua regia*.

D. H. J.



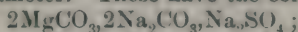
## Mineralogical Chemistry.

**Two Tellurium Minerals from Colorado.** WILLIAM F. HILLEBRAND (*Bull. U.S. Geol. Surv.*, 1905, No. 262, 55—57).—Emmonsite? (see Abstr., 1905, ii, 97). Tetradymite in cleavage masses of considerable size, from near Whitehorn, in Fremont Co., gave the following results:

Bi.	Te.	Se.	S.	Fe <sub>2</sub> O <sub>3</sub> .	Insol.	Total.	Sp. gr.
52.14	46.62	0.20	0.14	0.22	0.15	99.47	7.816

L. J. S.

**Tychite, a New Mineral; its Artificial Production and Relation to Northupite.** SAMUEL L. PENFIELD and GEORGE S. JAMIESON (*Amer. J. Sci.*, 1905, [iv], 20, 217—224).—In a parcel of octahedral crystals of northupite ( $\text{MgCO}_3, \text{Na}_2\text{CO}_3, \text{NaCl}$ , Pratt, Abstr., 1897, ii, 48) from Borax Lake, San Bernardino Co., California, one crystal was, by the merest chance, found to contain sulphate in place of chloride. Further search among several thousand crystals, each one separately being tested chemically, resulted in the discovery of only three more crystals of the new mineral, to which the name *tychite* (from *τύχη*, “luck”) is given. The crystals are small (3 mm. diam.) and are exactly like northupite in appearance. After preliminary tests, only one crystal (weighing 11 mg.) remained, and, in order to determine the composition of the mineral, it was necessary to prepare it artificially. This was done by a similar method to that employed for the artificial production of northupite (Schulten, Abstr., 1896, ii, 610). A solution of magnesium sulphate was added to one containing sodium carbonate and sulphate and the mixture heated in a steam-bath; at the end of five days the amorphous precipitate was almost wholly converted into perfectly developed octahedral crystals, about 0.15 mm. in diameter. These have the composition



they are optically isotropic, and have a refractive index of 1.510; sp. gr. 2.588; hardness  $3\frac{1}{4}$ . The natural crystals had sp. gr. 2.456 and 2.30, but enclosed impurities;  $\mu$  1.508.

The new mineral is thus very similar in its characters to northupite (sp. gr. 2.38;  $\mu$  1.514), and the apparent isomorphism of a sulphate with a chloride is only to be explained by the “mass effect” of the complex molecule (compare Penfield and Foote, Abstr., 1899, ii, 305; Hillebrand and Penfield, Abstr., 1902, ii, 667). The facts that *tychite* takes so long to form and that it is not decomposed by boiling water suggest that the molecule is one of considerable stability. Structural formulæ are given showing the relation between *tychite* and *northupite*.

An attempt to prepare crystals containing both sulphate and chloride was unsuccessful, the resulting octahedral crystals having the composition  $2\text{MgCO}_3, 2\text{Na}_2\text{CO}_3, \text{Na}_2\text{CO}_3$ .

L. J. S.

**Purpurite, a New Mineral.** L. C. GRATON and WALDEMAR T. SCHALLER (*Amer. J. Sci.*, 1905, [iv], 20, 146—151).—This mineral is found as small, irregular masses in pegmatite-veins and in the surrounding schists at the Faires tin mine, King's Mountain, Gaston Co., North Carolina, where it is associated with cassiterite and lithium minerals (lepidolite, spodumene, and tourmaline). Its most striking feature is its purple or dark red colour, and it has a peculiar satiny lustre or sheen; the powder and streak have a decided purple or deep rose colour. It possesses distinct cleavages, and from its optical characters appears to be orthorhombic. In very thin sections it is transparent and pleochroic. Hardness,  $4\frac{1}{4}$ ; sp. gr., 3.15. The following analysis gives the formula  $\text{Fe}_2\text{O}_3, 2\text{Mn}_2\text{O}_3, 3\text{P}_2\text{O}_5, 3\text{H}_2\text{O}$ , or, if manganic and ferric oxides are isomorphous,  $(\text{Mn}, \text{Fe})\text{PO}_4, \text{H}_2\text{O}$ . The water is given off at a low temperature, 3.31 per cent. being lost at  $105^\circ$ . The mineral is readily soluble in hydrochloric acid with evolution of chlorine. Several mineral arsenates containing manganic oxide are known, but a manganic phosphate has not been previously described.

$\text{Fe}_2\text{O}_3$ .	$\text{Mn}_2\text{O}_3$ .	$\text{P}_2\text{O}_5$ .	$\text{H}_2\text{O}$ .	$\text{CaO}$ .	$\text{Na}_2\text{O}$ .	$\text{Li}_2\text{O}$ .	Insol.	Total.
15.89	29.25	47.30	5.26	1.48	0.84	trace	0.52	100.54

Purpurite has been produced by the alteration of a yellowish-brown mineral with which it is found in association, and which is probably lithiophilite ( $\text{LiMnPO}_4$ ). It is itself always surrounded and penetrated by a black, pitchy material, which under the microscope appears to be a definite mineral; this alteration product of purpurite contains iron, manganese, phosphoric acid, and water, but as yet has not been completely determined.

Purpurite with the same characteristic purple colour has also been found in the lithium-bearing pegmatite-veins at Pala, in San Diego Co., California, where it has resulted by the alteration of triphylite,  $(\text{Fe}, \text{Mn})\text{LiPO}_4$ .  
L. J. S.

**Mineralogical Notes.** [Gyrolite, Prehnite, Anhydrite, Bournonite, Glaucodote.] WALDEMAR T. SCHALLER (*Bull. U.S. Geol. Surv.*, 1905, 262, 121—144).—*Gyrolite*.—This occurs as spherical, platy, or plumose aggregates filling veins in a basaltic rock at Fort Point, San Francisco, California. The colour is white and the lustre pearly. It is sometimes associated with apophyllite, but there is nothing to suggest that the gyrolite has been derived from the apophyllite. Cleavage flakes show the emergence of a negative bisectrix with  $2E = 0-25^\circ$ . Gyrolite is closely related to heulandite, and is possibly monoclinic. Analysis I agrees with Clarke's formula,  $5\text{H}_2\text{O}, 4\text{CaO}, 6\text{SiO}_2$ . Analysis II is of *prehnite* from Lower California.

	$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{CaO}$ .	$\text{MgO}$ .	$\text{Na}_2\text{O}$ .	$\text{K}_2\text{O}$ .	$\text{H}_2\text{O}$ .	Total.	Sp. gr.
I.	53.47	0.22	trace	32.00	trace	1.25	trace	13.21	100.15	2.39
II.	43.48	24.52	0.34	27.19	—	—	—	4.49	100.02	2.90

*Anhydrite*.—Small crystals have been found in Texas, but the exact locality is not known. Analysis gave:  $\text{CaO}$ , 41.01;  $\text{SO}_3$ , 58.87; loss on ignition, 0.22; insoluble, 0.06; total 100.16.

**Bournonite.**—Analysis III is of massive material from Bogg's mine, in Yavapai Co., Arizona.

**Glaucodote.**—A sample of cobalt ore from Sumpter, Oregon, consists of massive and imperfectly crystallised glaucodote and pyrites in a dark silicate rock. A small crystal was determined to be orthorhombic. Analysis IV corresponds with the formula  $\text{Co}_3\text{Fe}_2(\text{AsS})_5$ .

	S.	As.	Sb.	Pb.	Cu.	Fe.	Co.	Zn.	Mn.	Insol.	Total.
III.	20.04	2.81	18.99	40.21	15.12	0.35	—	0.35	trace	1.67	99.54
IV.	18.46	39.84	—	—	—	12.45	20.23	—	—	9.38	100.36

The chemical (Abstr., 1904, ii, 348) and crystallographic characters of several other minerals from American localities are given.

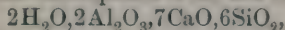
L. J. S.

**Californite.** FRANK W. CLARKE and GEORGE STEIGER (*Bull. U.S. Geol. Surv.*, 1905, No. 262, 72—74).—A compact variety of idocrase resembling jade in appearance, from Siskiyou Co., California, has been described by G. F. Kunz under the name californite (Abstr., 1904, ii, 50). Similar material (anal. I) is found also in Fresno Co., California: with it is associated a compact white mineral, somewhat resembling chalcedony in appearance, which is optically isotropic and is proved by analysis II to be garnet.

	$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{FeO}$ .	$\text{MnO}$ .	$\text{MgO}$ .	$\text{CaO}$ .
I.	36.55	18.89	0.74	0.74	nil	2.33	35.97
II.	38.59	22.24	0.45	0.36	0.10	0.64	35.97

	$\text{H}_2\text{O}$ (105°).	$\text{H}_2\text{O}$ (>105°).	$\text{CO}_2$ .	F.	Total.	Sp. gr.
I.	0.58	3.42	0.91	0.13	100.26	3.359
II.	0.31	0.80	0.39	0.17	100.02	3.586

Analysis I of idocrase corresponds with the formula



or, rejecting part of the water,  $\text{Al}_2\text{Ca}_7(\text{SiO}_4)_6(\text{Al}\cdot\text{OH})_2$ . A study of previously published analyses of idocrase suggests that the variations in composition of this species may be explained by mixtures of the following molecules, the first and third of which usually predominate:  $\text{Al}_2\text{Ca}_7(\text{SiO}_4)_6(\text{Al}\cdot\text{OH})_2$ ;  $\text{Al}_2\text{Ca}_7(\text{SiO}_4)_6(\text{AlO}_2\text{H}_2)_4$ ;  $\text{Al}_2\text{Ca}_7(\text{SiO}_4)_6\text{H}_4$ ;  $\text{Al}_2\text{Ca}_7(\text{SiO}_4)_6\text{Ca}_2$ . About one-seventh of the calcium is replaced by magnesium, and in the variety wiluite the group (BOH) probably occurs. Idocrase is a basic orthosilicate belonging to the same group as garnet, epidote, and the scapolites; they are all products of contact-metamorphism and yield the same alteration-products.

L. J. S.

**Causes of Variegation in Keuper Marls.** GERALD T. MOODY (*Quart. J. Geol. Soc.*, 1905, 61, 431—437).—Several analyses are given of the red and of the greenish-grey portions, each selected from the same hand-specimens, of Keuper Marls from the West of England. The following (I, green portion; II, red portion), of material from Wainlode Cliff on the Severn, may be quoted as examples:



	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	CO <sub>2</sub> .	H <sub>2</sub> O (100°).	C (organic).	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	TiO <sub>2</sub> .	Alk., comb. H <sub>2</sub> O, undet.
I.	0·87	0·96	7·37	6·10	13·01	3·01	0·092	50·84	13·12	0·42	4·208
II.	3·80	0·91	5·18	5·42	10·21	3·72	0·106	50·91	12·98	0·33	6·434
III.	4·96	0·61	4·92	4·77	9·61	75·13					

As shown by these analyses, as well as by all the others, the red portion contains more ferric oxide and less calcium and magnesium carbonates than the green portion of the same hand-specimen. It was found that from the red portion the ferric oxide cannot be extracted by dilute acid so long as carbonates are present. The green portion cannot therefore have been produced by the bleaching of the red portion. Neither can the red portion have been produced by the oxidation of ferrous iron in the green portion, since this constituent is present in both portions in about the same amounts, existing probably as a ferrous silicate. When, however, a chalybeate water permeates a calcareous rock, iron is deposited as ferrous carbonate, and an equivalent amount of magnesium and calcium passes into solution; on subsequent exposure to air, the ferrous carbonate is oxidised to ferric oxide. By passing an artificial chalybeate water (ferrous hydrogen carbonate solution) over the finely-powdered green marl for several hours and afterwards drying in contact with the air, a product was obtained which closely resembled the natural red marl both in colour and composition (anal. III). It is therefore concluded that the variegation of the Keuper Marls and of other calcareous rocks has been brought about by the percolation of chalybeate water through the more porous portions of the lighter coloured mass.

L. J. S.

**The Rodeo Meteorite.** OLIVER C. FARRINGTON (*Field Columbian Museum, Geol. Ser.*, 1905, 3, 1—6).—This mass of iron, weighing 97 pounds, was found in 1852 near Rodeo, in the State of Durango, Mexico. It is an octahedrite of medium coarseness, with large inclusions of schreibersite and some graphite, but no troilite. Analysis by H. W. Nichols gave:

Fe.	Ni.	Co.	Cu.	P.	S.	C.	Total.
89·84	8·79	0·28	0·07	0·80	0·02	0·09	99·89

L. J. S.

**The Shelburne Meteorite.** LEONARD H. BORGSTRÖM (*Trans. R. Astron. Soc. Canada*, 1905, [for 1904], 69—94).—This meteorite was observed to fall on August 13, 1904, near the village of Shelburne, Grey Co., Ontario; two masses, weighing 12·6 and 6 kilos., were found. They penetrated the soil to depths of 0·55 and 0·40 metre respectively, and from this it is calculated that their velocity was 172 and 165 metres per second respectively; from other data (air resistance and gravity) the velocities are calculated as 177 and 157 metres per second respectively. The structure of the stones is chondritic. Sp. gr. 3·499. By microscopical examination, four different zones are distinguished in the crust: (1) the outer black crust of varying thickness,

but averaging 0.1 mm.; (2) a layer of brown glass, 0.02 to 0.03 mm. thick; (3) a colourless layer, consisting of grains of silicates, 0.02 to 0.10 mm. thick; (4) a layer consisting of silicates with many opaque particles, 0.1 to 0.4 mm. thick. From analyses of the metallic portion and of the soluble and insoluble silicates, the following general composition of the stone is obtained:

SiO <sub>2</sub>	Fe.	Ni.	Co.	FeO.	MnO.	Al <sub>2</sub> O <sub>3</sub> .	Cr <sub>2</sub> O <sub>3</sub> .
39.19	10.70	0.78	0.04	15.16	0.12	2.15	0.62
CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	S.	P.	Total.	
1.75	26.24	0.22	0.73	1.61	0.06	99.37	

This corresponds with the mineralogical composition: nickel-iron, 8.5; troilite, 4.5; chromite, 0.8; schreibersite, 0.4; olivine, 45.0; enstatite, 27.8; aluminium silicate (maskelynite?), 13.0 per cent.

The metallic portion contains: Fe, 91.08; Ni, 8.44; Co, 0.48 per cent. The olivine is an iron-rich variety, approaching fayalite, and has the following composition:

SiO <sub>2</sub> .	FeO.	MgO.	CaO.	Al <sub>2</sub> O <sub>3</sub> .	Cr <sub>2</sub> O <sub>3</sub> .
36.41	23.22	39.66	0.33	0.31	0.07

L. J. S.

**Mineral Waters of Fumade.** A. ASTRUC and J. DELORME (*Bull. Soc. chim.*, 1905, [iii], 33, 998—1000).—A list is given of the chief mineral springs of Fumade (Gard), of which the most important are the Romaine spring and the Zoé spring, analyses of which are given.

G. Y.

## Physiological Chemistry.

**Permeability of the Membrane of Fundulus Eggs.** ORVILLE H. BROWN (*Amer. J. Physiol.*, 1905, 14, 354—358).—The membrane of the eggs of *Fundulus heteroclitus* is impermeable to salts and water during the first six or eight hours: that is, eggs placed in distilled water do not lose their salts during that period. It becomes permeable after about eighteen or twenty hours, and is equally so to water and salts.

W. D. H.

**Chemistry of Fishes' Eggs.** OLOF HAMMARSTEN (*Chem. Centr.*, 1905, ii, 342; from *Skand. Archiv Physiol.*, 17, 113—132).—Ripe and unripe eggs of the perch were examined. The proteid is mainly a vitellin-like nucleo-albumin, which does not yield purine derivatives. Mucin is also present, and methods for the separation of the two are given.

The shell of the ripe eggs consists mainly of mucinogen and a little mucin. In the unripe eggs, both are present in only small amount.

W. D. H.

**Response of the Developing Retina to Light and Radium.**

THOMAS H. MILROY (*J. Physiol.*, 1905, 33, 69—76).—Up to the fifteenth day of incubation, the chick's retina shows no signs of response to light, such as are observed in the fully-developed eye. Beyond this time, the pigment cells respond to light by throwing out processes which contain pigment, and which clasp the ends of the young rods and cones. There is also a contraction of the inner segments of the rods and cones. As development proceeds, the responses become more distinct, and take place even when light reaches the eye after filtration through the shell. The effects of monochromatic and white light are the same. There is no delay in development in the case of embryos developed in the light. The intracocular fluorescence produced by radium is not sufficient to evoke such responses, but the pigment is scattered through the cell-bodies and driven backwards into the surrounding tissues. Radium emanations gradually produce a disintegration of all the retinal elements, starting with those in front.

W. D. H.

**Gas Exchange in Some Lower Animals and its Dependence on Partial Pressure of Oxygen.**

TORSTEN THUNBERG (*Chem. Centr.*, 1905, ii, 345; from *Skand. Arch. Physiol.*, 17, i, 133—195).—The investigations were made in certain molluscs and worms. In pure oxygen, the uptake of that gas is much increased. Differences between the different animals are noted in detail.

W. D. H.

**Estimation of the Gas set free in the Body after Rapid Decompression from High Atmospheric Pressures.** C. HAM and LEONARD E. HILL (*Proc. Physiol. Soc.*, 1905, vi—vii; *J. Physiol.*, 33).—The gases from the bodies of rats subjected to this treatment were analysed. Most was found in the peritoneal cavity. The total gas varied in three experiments from 9 to 13 c.c. It contained from 6·7 to 16 per cent. of carbon dioxide, and from 2 to 8·7 per cent. of oxygen, the rest being nitrogen.

W. D. H.

**Oxygen Inhalation as a means of preventing Caisson and Divers' Sickness.** C. HAM and LEONARD E. HILL (*Proc. Physiol. Soc.*, 1905, vii—viii; *J. Physiol.*, 33).—H. von Schrötter has suggested the use of oxygen inhalation (to wash out the nitrogen) for five minutes previous to decompression of caisson-workers. The method is theoretically correct, and in animals is efficacious in preventing death from embolism. It, however, is unsafe to use the method at pressures of 50 lbs. and upwards on account of the danger of oxygen-poisoning.

W. D. H.

**Effect of Increased Carbon Dioxide Tension, together with Increased Atmospheric Pressure.** C. HAM and LEONARD E. HILL (*Proc. Physiol. Soc.*, 1905, v—vi; *J. Physiol.*, 33).—The conclusion is drawn that increased pulmonary ventilation depends on the carbon dioxide tension. As others have shown, oxygen tensions of less than 10 per cent. atmosphere alter the respiration, but the jerky movements are quite unlike the deep heavings produced by carbon dioxide.

W. D. H.



**Effects of High External Temperature on the Body-temperature, Respiration, and Circulation in Man.** A. E. BOYCOTT and JOHN S. HALDANE (*Proc. Physiol. Soc.*, 1905, xii; *J. Physiol.*, 33; *J. Hygiene*, 1905, 5, 494—513).—In still air, the body-temperature rises above normal when the wet-bulb thermometer rises over  $31^{\circ}$  ( $88^{\circ}$  F.), and remains normal whatever the external temperature may be when the wet-bulb thermometer does not rise beyond this point. The greater the rise above  $31^{\circ}$ , the more rapid the rise of body-temperature. In moving air, the limit is  $35^{\circ}$ . With rise of body-temperature, a marked fall in the alveolar carbon dioxide pressure is observed, and an increase in the pulse rate.

W. D. H.

**Absorption Coefficients of Blood and Blood-plasma for Gases.** CHRISTIAN BOHR (*Chem. Centr.*, 1905, ii, 339—340; from *Skand. Archiv Physiol.*, 17, 104—112).—In order to settle the important biological questions relating to the chemical union of carbon dioxide and oxygen in part in blood, blood-plasma, and corpuscles, it is necessary to know Bunsen's absorption coefficients for these media in order to calculate the quantities of these gases which are absorbed in proportion to the pressure. The difficulty of the investigation is increased by the fact that a part of the gas is present in dissociable compounds. Zuntz has estimated the absorption coefficient of gases which do not form compounds with blood constituents, and from these calculates that of oxygen, on the assumption that the proportion between the coefficients for blood and water is constant for all gases.

Whether this is the case has never been investigated. In the present research, the indifferent gas oxygen was used for serum, and hydrogen for the total blood. The fluid was shaken with the gas at constant temperature, and the gas subsequently extracted by the air-pump. The results came out as anticipated with only a small error. The figures obtained and the coefficients reckoned from them are given in tables.

W. D. H.

**Composition of the Stroma of the Blood-discs and Hæmolysis.** OLINTO PASCUCCI (*Beitr. chem. Physiol. Path.*, 6, 543—551, 552—566).—The observations lend no support to Rollett's idea of a stroma, but rather to its membranous nature; it is a proteid permeable membrane with a large amount of lecithin, cholesterol, and a cerebroside. It has the chemical and physical behaviour of Overton's "lipoid" membranes found in protoplasmic cells. Substances which produce hæmolysis do so by acting on the membrane; this view is supported by numerous experiments on membranes of similar composition.

W. D. H.

**Koeppé's Hypothesis of the Nature of the Red Blood Corpuscles.** G. GRYNs (*Pflüger's Archiv*, 1905, 109, 289—299. Compare Koeppé, *Abstr.*, 1903, ii, 736; 1904, ii, 650; this vol., ii, 331).—A criticism of Koeppé's view that the red discs are covered with a membrane consisting essentially of fatty materials. The main points are as follows. (1) If the membrane consists of fatty material it would not be moistened by the water, and rupture could not therefore be

due to differences in osmotic pressure. (2) After rupture, the membrane, if of a fatty nature, should be recognisable by its high refractive power. (3) The membrane is not dissolved by alcohol or ether.

The results with regard to centrifugalising are also criticised.

J. J. S.

**Glycuronic Acid of Blood.** RAPHAEL LÉPINE and BOULUD (*Compt. rend.*, 1905, 141, 453—456. Compare Abstr., 1903, ii, 493, and 1904, ii, 422).—It is improbable that glycuronic acid is formed at the expense of the lævulose, and the small amount of dextrose present in blood is insufficient to account for it. It is probably produced from dextrose obtained from the considerable amount of glucoside nearly always present in blood.

N. H. J. M.

**Action of Vaso-dilators.** V. E. HENDERSON and OTTO LOEWI (*Chem. Centr.*, 1905, ii, 344; from *Arch. exp. Path. Pharm.*, 53, 56—61).—In vaso-dilatation, not only are the vessels widened in the sense that their total transverse diameter is increased, but also, and probably mainly, by an increase only in the lumen. Hence it is possible for an organ like the kidney to have dilated blood vessels without an increase of volume.

W. D. H.

**Invertin in Blood.** ERNST WEINLAND (*Zeit. Biol.*, 1905, 47, 279—288).—In the young dog, invertin is only found in the small intestine normally, but after continuous subcutaneous injection of sucrose, it is found also in the blood. If inulin is used instead, no evidence was found of the formation of a ferment able to split it up.

W. D. H.

**Anti-precipitins.** P. BERMBACH (*Pflüger's Archiv*, 1905, 109, 73—77).—The fact that a serum will prevent the precipitating action of precipitin is not trustworthy evidence of the presence of an anti-precipitin. Certainly, long treatment of an animal (rabbit) with injections of precipitin does not lead to the formation of an anti-substance.

W. D. H.

**Chemistry of Digestion.** I. E. S. LONDON (*Zeit. physiol. Chem.*, 1905, 45, 381—385).—A preliminary description of the methods of making fistulæ in dogs (in accordance with Pawloff's ideas), by which it is proposed to investigate some of the questions of digestion-chemistry.

W. D. H.

**Chemical Mechanism of Gastric Secretion.** J. S. EDKINS (*Proc. Roy. Soc.*, 1905, 76 B, 376).—The mechanical and nervous provocation to the secretion of gastric juice must be supplemented by a theory of chemical stimulation, as Bayliss and Starling have shown to be the case in the pancreas. If an extract of the mucous membrane of the fundus of the stomach, made with a 5 per cent. solution of dextrin, is injected into the jugular vein, no secretion of gastric juice follows; the same is true for dextrin by itself. But a dextrin

extract of the pyloric mucous membrane excites a small secretion of the juice. The same is true for extracts made with dextrose or maltose, or peptone, but the positive result with pyloric extracts is more marked. It therefore appears that salivary digestion provides a chemical cause for the secretion of the next juice in order. The term suggested for the active substance is "*gastrin*." It is not destroyed by boiling, and so falls into line with many other "hormones" (Starling's term for these chemical stimuli). W. D. H.

**Formation of Hydrochloric Acid in the Stomach.** ALFRED BENRATH and FRITZ SACHS (*Pflüger's Archiv*, 1905, 109, 466—472).—Absence of chlorine ions in the food does not prevent formation of hydrochloric acid. Presence of chlorine ions in the food does not necessarily evoke hydrochloric acid formation. Introduction of chlorine-free salt solutions into the stomach does not abolish the acid of the secretion which comes from the blood. The quantity of the acid secreted has no relation to the chlorine administered. The formation of hydrobromic acid after introducing sodium bromide into the stomach is also explained by absorption into the blood and subsequent glandular activity. The impermeability of the stomach to chlorine ions is not proved. These facts all tell against Koppe's theory. W. D. H.

**Antipepsin.** OSW. SCHWARZ (*Beitr. chem. Physiol. Path.*, 1905, 3, 524—542).—The existence of substances antagonistic to ferments has been abundantly proved by numerous researches, references to which are given. In some cases, the appearance of the anti-substance is provoked by injection of the ferment, as in researches on immunity; in other cases, the anti-substance is normally present, and in the case of the stomach the existence of antipepsin explains why the stomach does not digest itself. It has been shown that antitrypsin resists the action of heat (Pollak); the same is true for the substance which is inhibitory to peptic activity. It is precipitable by alcohol. It is present in preparations of pepsin, and the inhibitory influence, measured by experiments with Mett's tubes, is proportional to the amount of boiled pepsin solution added. Albumoses act inhibitingly in a similar way, but the boiled and filtered solutions of pepsin which are inhibitory give no biuret reaction. Possibly the biuret reaction is not a sufficiently sensitive one to detect the small amount of substance present. Danilewsky and others deny the proteid nature of antipepsin. The question arises whether the latter substance is preformed or an artifact produced by boiling the pepsin solution. The answer given is that the former alternative is correct. If proteid is soaked in pepsin solution, the pepsin is removed by absorption, and the residual fluid contains no pepsin, but antipepsin is present before and after boiling it. The antipepsin does not destroy pepsin, but forms with it an inactive "neutral" complex. W. D. H.

**A Fat-hydrolysing Ferment from the Mucous Membrane of the Stomach.** ALBERT FROMME (*Beitr. chem. Physiol. Path.*, 1905, 7, 51—76. Compare Volhard, *Abstr.*, 1901, ii, 518; 1903, ii, 120, 494).—The author confirms the presence of a fat-hydrolysing



ferment (steapsin) in the mucous membrane of the stomach. Similar ferments may be obtained from dogs and pigs, either from the dry material or by glycerol extraction. The pylorus end of the stomach does not contain such a ferment. The ferment from pigs behaves differently from the human ferment. Its action is accelerated by alkali and retarded by acid. The ferment obtained from dog's stomach by glycerol extraction is not affected by acids, but is sensitive to alkalis, and thus resembles the human steapsin. J. J. S.

**Extent to which Fats are Decomposed in the Stomach.** ADOLF ZINSSER (*Beitr. chem. Physiol. Path.*, 1905, 7, 31—50. Compare Fromme, preceding abstract).—When a fat emulsion is introduced into a normal stomach, about 25 per cent. of the fat is hydrolysed at the end of one hour, and in all probability this value obtained experimentally is below the actual value. No direct relationship can be established between the time and degree of hydrolysis.

The hydrolysis is less in cases of hyperacidity, but considerably greater (45 per cent. in one hour) in cases of achylia gastrica. The decomposition is produced by an enzyme which remains behind when the juices are filtered. J. J. S.

**Estimation of Parachymosin, and Time Laws of Human Rennin Ferment.** GEORG BECKER (*Beitr. chem. Physiol. Path.*, 1905, 7, 89—119. Compare Fuld, *Abstr.*, 1902, ii, 415, 675).—The ordinary time law for coagulation (namely, amount of ferment  $\times$  time of coagulation = constant) does not hold good for parachymosin (Bang, *Abstr.*, 1900, ii, 356). The relative falling off in the coagulating action when experiments are conducted for a long time is not due to the liquids necessarily required for dilution. The addition of calcium chloride and acid favours the coagulation, and when added in certain proportions and allowed to react for a short time (five hours), the coagulation approximates to the ordinary time law for calves' rennin.

For the estimation of parachymosin, the simplest method is to determine the amount of juice required to produce the coagulation of 10 c.c. of milk containing 2 per cent. of hydrochloric acid, when the mixture is kept in an ice-chest for thirty minutes and then warmed for five minutes. J. J. S.

**Time and Fermentation Laws of Pancreas-steapsin.** HANS ENGEL (*Beitr. chem. Physiol. Path.*, 1905, 7, 77—88. Compare Schütz, *Abstr.*, 1885, 1147; Borissow and Linossier, *J. Physiol. Path.*, 1899, 1; Schütz and Huppert, 1900, ii, 553).—The Schütz-Huppert laws, namely,  $v/\sqrt{ft}$  = constant, hold good for pancreas-steapsin, and the amount of ferment can be calculated from the equation  $x = v^2/ft$ , where  $v$  = percentage of fat decomposed,  $f$  the volume of ferment solution in c.c., and  $t$  the time in hours. J. J. S.

**End-products of Pancreatic Autolysis.** PHOEBUS A. LEVENE (*Zeit. physiol. Chem.*, 1905, 45, 498—499. Compare *Abstr.*, 1903, ii, 670, 737; 1904, ii, 425).—The statement made by Kutscher and Lohmann (this vol., ii, 466) that thymine and uracil are not products

of pancreatic autolysis is incorrect. If sufficient time is allowed to elapse, they are always found by the author's method. W. D. H.

**Utilisation of Carbohydrates without Intervention of Alimentary Digestion Processes.** LAFAYETTE B. MENDEL and PHILIP H. MITCHELL (*Amer. J. Physiol.*, 1905, 14, 239—247).—There are no profound differences between glycogen and dextrin in their "parenteral" introduction into animals; glycogen is retained rather better. The failure of the organism to retain carbohydrates, which it is not fitted to transform into mono-saccharides by ferment action, is well illustrated by experiments with inulin and isolichenin. The importance of the alimentary digestive changes in the metabolism of carbohydrates stands on a firm footing. W. D. H.

**Influence of Movement of the Body on the Digestion and Absorption of Food-stuffs in the Horse.** ARTHUR SCHEUNERT (*Pflüger's Archiv*, 1905, 109, 145—198).—Movement during the digestion of food tends to retard the passage of material from the stomach to the intestine, and at the same time increases the percentage of water in the stomach. This is due mainly to the increased secretion of water from the mucous membrane during motion. In spite of the increased percentage of water, movement of the body, even galloping, does not tend to mix the stomach contents.

Motion increases the digestion of carbohydrate and the general secretion of the stomach juices, but at first tends to lessen the digestion of nitrogenous substances and proteids, but later this is also intensified, as is also the absorption of food by the stomach.

The decomposition and absorption in the intestine are only slightly affected by bodily movement.

Most of the experiments were made with relatively old horses, and the results vary somewhat with the individual animals. J. J. S.

**Movements of the Surviving Intestine.** JOHN N. LANGLEY and RUDOLF MAGNUS (*J. Physiol.*, 1905, 33, 34—51. Compare Magnus, *Abstr.*, 1905, ii, 466).—The experiments of Bayliss and Starling on the dog's intestine are in the main true also for cat and rabbit. Strong and fairly regular contractions can be obtained after section of vagi and superior mesenteric nerves by direct application of 1 per cent. atropine, 0.5 to 3 per cent. strychnine, and 1 to 10 per cent. cocaine. These and the normal contractions are either lessened or abolished by a stimulus applied above the balloon which is inserted for the registration of the movements. Inhibition is usually produced by direct application of sodium chloride solutions. Degenerative section of the nerves does not abolish any of these effects or the inhibition normally produced by adrenaline and by nicotine. W. D. H.

**Action of the Mucous Membrane of the Surviving Intestine on Soaps, Fats, and Fatty Acids.** OTTO FRANK and ADOLF RITTER (*Zeit. Biol.*, 1905, 47, 251—267).—In order to determine the seat of synthesis of fats from their hydrolytic products formed during digestion, Ewald, and later Hamburger, incubated

finely-divided intestinal mucous membrane with these products, and determined the amount of neutral fat after some hours. Their results were irregular and unconvincing. Moore could not discover any new formation of fat at all. The present experiments, carried out with calf's mucous membrane and various mixtures of soap, fatty acids, and glycerol, confirm Moore's statement. Considerable importance is attributed to the formation of carbon dioxide during digestion, and this substance is believed to be responsible for the liberation of fatty acids from soaps.

W. D. H.

**Liver Autolysis.** JULIUS BAER and ADAM LOEB (*Chem. Centr.*, 1905, ii, 345; from *Arch. exp. Path. Pharm.*, 53, 1—14).—The question investigated is whether the blood contains a true anti-ferment against autolysis. Serum inhibits autolysis of the liver even after it has been heated to 95°. The evidence is therefore against an anti-ferment. Acid added to the serum increases the autolysis; solution of sodium hydrogen carbonate in small quantities acts in the same way. Serum globulin hastens, serum albumin delays it. Boiling destroys the hastening action of the former, but not the inhibiting action of the latter proteid.

W. D. H.

[Effect of Feeding with Material Rich in Arginine.] GUSTAV ORGLMEISTER (*Beitr. chem. Physiol. Path.*, 1905, 7, 27—30).—Feeding dogs with material rich in arginine does not appear to increase the amounts of arginine in the various organs, and feeding birds with benzoic acid does not tend to decrease the amounts of arginine to any appreciable extent.

J. J. S.

**The Nutritive Value of Amino-compounds.** BOLESLAUS VON STRUSIEWICZ (*Zeit. Biol.*, 1905, 47, 143—185).—From experiments on sheep, the conclusion is drawn that the metabolic value of amino-compounds is the same as that of proteid.

W. D. H.

**Metabolic Changes during the Metamorphosis of the Meat-fly** (*Calliphora Vomitoria*). ERNST WEINLAND (*Zeit. Biol.*, 1905, 47, 186—231).—In the metamorphosis of the pupa there is at first lessening of respiratory processes; these then remain at a low level, and finally, with the appearance of movements, they are increased and lead to great loss of weight. Combustion of fat is the main source of the carbon dioxide given out; no oxidation of carbohydrate was proved to occur, but there is the formation of a small amount of carbohydrate material (chitin), which is the result of the breakdown of nitrogenous substances.

W. D. H.

**Folin's Theory of Proteid Metabolism.** DIARMID NOËL PATON (*J. Physiol.*, 1905, 33, 1—11. See Folin, *Abstr.*, 1905, ii, 183, 268).—Folin's theory is, on the whole, agreed with, but certain differences of detail are noted; for instance, in the dog, creatinine excretion is not so constant as in man. A doubt is expressed whether any hard and fast line can be drawn between endogenous and exogenous proteid metabolism, and urea may probably be a result of both. Some



of Folin's results may be explained by variations in the activity of the liver, for it is here that urea precursors are transformed into that substance. Of all diets, proteid is the best to stimulate hepatic metabolism, as gauged by the amount of bile secreted. Hence, on a diet poor in proteid it may be sluggish, and therefore fail to convert much of the waste nitrogen into urea, whilst on a diet rich in proteid the conversion will be more complete. The amount of sulphur which is completely oxidised must also depend on hepatic activity.

W. D. H.

**Gelatin in Metabolism.** MAURICE KAUFFMANN (*Pflüger's Archiv*, 1905, 109, 440—465).—From experiments on two dogs and also on the author, it was determined that the proteid (plasmon) in the diet can be replaced to the extent of one-fifth by gelatin without harm. This can be exceeded and the proteid completely replaced by gelatin if it is mixed with tyrosine, cystine, and tryptophan. Both dogs, however, died.

W. D. H.

**Chemical Correlation of the Functions of the Body.** ERNEST H. STARLING (*Lancet*, 1905, ii, 501—503, 579—583).—A series of lectures (Croonian lectures, Royal College of Physicians) giving an account of the numerous researches recently carried out by the author and his colleagues on the chemical messengers which bring about correlation of function between different organs of the body. The general name bestowed upon them is *hormone*. Some, like secretin, stimulate increased activity and katabolism, others involve increased assimilation and growth. Under the latter head fall the internal secretions of the thyroid and generative organs. Preliminary experiments indicate that it is an internal secretion of the fœtus which leads to the growth of the mammary gland.

W. D. H.

**Occurrence of Lithium in the Human Body.** ERICH HERRMANN (*Pflüger's Archiv*, 1905, 109, 26—50).—Lithium appears to be present in practically all the organs of the human body. It is also present in the earlier stages of development (fœtus), where the feeding has been entirely by means of the maternal blood. The lungs appear to be richest in lithium.

The detection of lithium in presence of considerable quantities of phosphates cannot be carried out in the usual manner, and a method is recommended which is based on the fact that lead phosphate is insoluble in acetic acid and lithium acetate is readily soluble in water.

J. J. S.

**Conditions for the Formation of Acetone [in the Body].** RICHARD WALDVOGEL (*Beitr. chem. Physiol. Path.*, 1905, 7, 150—151. Compare Satta, this vol., ii, 406).—Polemical.

J. J. S.

**Fate of Oil Injected Subcutaneously.** YANDELL HENDERSON and EDWARD FRANCIS CROFUTT (*Amer. J. Physiol.*, 1905, 14, 193—202).—Cotton-seed oil injected subcutaneously in dogs is rapidly and widely distributed through the subcutaneous spaces, but it is not transformed

*in situ* into adipose tissue. The tissues react to its presence as to any non-irritating foreign substance. It does not appear in detectable amounts in blood, lymph, or milk. It is ultimately absorbed and utilised, but the process is so slow that oil injections are practically destitute of nutritive value.

W. D. H.

**Effect of Dextrose and Certain Salts on the Rate of Transformation of Glycogen into Dextrose.** C. HUGH NEILSON and OLIVER P. TERRY (*Amer. J. Physiol.*, 1905, 14, 105—111).—It is suggested that the change of dextrose into glycogen and *vice versa* in the body is due to the reversible action of a single enzyme. The change into sugar is certainly retarded by excess of sugar. Calcium chloride retards, and sodium citrate accelerates, the change. The action of salts is probably one on cell-membranes.

W. D. H.

**Distribution of Glucothionic Acid in the Animal Organism.** JOHN A. MANDEL and PHOEBUS A. LEVENE (*Zeit. physiol. Chem.*, 1905, 45, 386—392. Compare Abstr., 1903, ii, 314).—By the use of Levene's method, glucothionic acid was isolated from mammary gland, kidney, liver, and pancreas.

W. D. H.

**Cystine.** EMIL FISCHER and UMETARŌ SUZUKI (*Zeit. physiol. Chem.*, 1905, 45, 405—411. Compare Abstr., 1905, i, 121).—By dissolving cystine in dry methyl alcohol and allowing a stream of dry hydrogen chloride to pass through it, a cystine dimethyl ester hydrochloride was obtained. This forms crystalline salts which serve to identify cystine. No differences could be detected between cystine prepared from calculi and that prepared from horse-hair. Neuberg and Mayer's contrary result is probably explicable by admixture with tyrosine.

W. D. H.

**The Silver Reaction in Animal and Vegetable Tissues.** ARCHIBALD B. MACALLUM (*Proc. Roy. Soc.*, 1905, 76 B, 217—229).—One view, which seeks to explain the well-known reduction stain with silver nitrate so much used in histology, states that a silver-proteid compound in the cementing material is the substance which is acted on by light. But proteids freed from salts, or tissues washed free from salts, no longer give the reaction. Taurine and creatine out of a large number of organic substances examined give the reaction, but these exceptions may be eliminated. The conclusion is drawn that the halogen in haloid form is the cause of the reaction. Intercellular material is specially rich in chlorides, and the reaction may be used to determine the distribution of chlorides in histological specimens. The normal nuclei of animal and vegetable cells do not contain chlorides at all.

W. D. H.

**The Masking of Ionic Effects by Organic Substances.** PERCY GOLDTHWAIT STILES and WILLIAM HERBERT BEERS (*Amer. J. Physiol.*, 1905, 14, 133—137).—Well-known ionic effects on muscle are masked by the presence of organic substances with large molecules; this is regarded as an indication of combination.

W. D. H.

**Supposed Equivalence of Sodium and Lithium Ions in Skeletal Muscle.** CARL SPENCER MILLIKEN and PERCY GOLDTHWAIT STILES (*Amer. J. Physiol.*, 1905, 14, 359—365).—The ions sodium and lithium are very similar physically, but are not equivalent physiologically. There is, however, no foreign ion which is so slow to make a noteworthy change in skeletal muscle as lithium, but when much of the normal sodium is replaced by lithium, a characteristic fall in irritability follows. No irreparable harm results, for by a reversal of treatment the muscle can be restored. The harmlessness of lithium does not obtain for all tissues.

W. D. H.

**Paths of Absorption from the Liver.** LAFAYETTE B. MENDEL and FRANK P. UNDERHILL (*Amer. J. Physiol.*, 1905, 14, 252—258).—Absorption of injected materials (milk, &c.) from lymph spaces is not different in the liver from what it is in serous cavities and other lymph spaces.

W. D. H.

**Physiology of Molluscs. II. Inorganic Constituents of the Liver of *Sycotypus*.** LAFAYETTE B. MENDEL and HAROLD C. BRADLEY (*Amer. J. Physiol.*, 1905, 14, 313—327).—Copper, zinc, iron, calcium, magnesium, and phosphorus are normal constituents of the liver of *Sycotypus*. Copper comprises 8 per cent. of the total ash, or 1.2 per cent. of the dry tissue; the corresponding numbers for zinc are 15 and 1.7; both are present in cells and the connective tissue, but the most copper is in the green pigment cells. Both are derived from the food, and are stored in the liver for purposes of blood formation; a respiratory proteid peculiar to this animal occurs in the blood and contains both metals.

W. D. H.

**The Tauro-choleic Acid of Ox Bile.** ALF. GULLBRING (*Zeit. physiol. Chem.*, 1905, 45, 448—458).—Glycocholic and taurocholic acids were found in ox bile by Strecker and prepared in a state of purity by Hammarsten; glycocholeic acid was isolated by Wahlgren; the present investigation is a search for the fourth member of the group, namely, taurocholeic acid. It was found present in small quantities, but was not obtained in crystalline form.

W. D. H.

**Presence of Bile Pigments in Leeches.** CAMILLE SPIESS (*Compt. rend.*, 1905, 141, 333—335).—The product of secretion of the peritoneal cells contains one of the specific principles of the bile, elaborated by the hepatic cells of higher animals.

The peritoneal cells of leeches accumulate a pigment analogous to, if not identical with, the bile pigments of the vertebrates.

N. H. J. M.

**Gaseous Metabolism of the Kidney.** JOSEPH BARCROFT and T. GREGOR BRODIE (*J. Physiol.*, 1905, 33, 52—68. Compare this vol., ii, 99).—The diuresis produced by urea and sodium sulphate is accompanied by a large increase of the oxygen absorbed by the kidney. This is also the case in phloridzin diabetes. There is not always a simultaneous increase in the carbon dioxide leaving the organ.



The work of concentration, as calculated from the freezing points of the blood and urine, accounts for only a small fraction of the whole energy transformed by the kidney: the two quantities have no fixed relation to one another. In so far as urine of the same freezing point as the serum would represent Ludwig's glomerular filtrate, the experiments lend no support to his theory, for the source of energy for the production of such urine should be the heart and not the kidney; yet it is in these circumstances that the kidney is most active. Diuresis is not always accompanied by increased blood-flow; when it is, the former outlasts the latter. Over a large number of experiments there is an approximate equality between the volumes of oxygen absorbed and the carbon dioxide excreted by the kidney. This suggests, though it does not exactly prove, that the substance of the kidney is completely broken down in the organ itself. In some cases, urine of less molecular concentration than the serum was obtained; the divergence being greatest when the flow of urine has been most rapid.

W. D. H.

**Effect of Hypnotics and Anti-pyretics on the Rate of Catalysis of Hydrogen Dioxide by Kidney Extract.** C. HUGH NEILSON and OLIVER P. TERRY (*Amer. J. Physiol.*, 1905, 14, 248—251).—Hypnotics have a sedative influence on ferment action, and various drugs of this class were found to retard the catalytic action of kidney extract. Antipyrin was the only anti-pyretic investigated, as it is one of few sufficiently soluble for such experiments. It has the opposite effect.

W. D. H.

**Variations in the Amount of Casein contained in Human Milk.** GUSTAVE PATEIN and L. DAVAL (*J. Pharm. Chim.*, 1905, 22, 193—200).—The results of 16 analyses show that, one month after delivery, human milk contains on the average 1.0 per cent. of casein, and that the variation in the amount is within narrow limits. The average amount found in 12 analyses of the milk of a woman, 4 to 10 days after delivery, was 1.77 per cent. In estimating casein in milk, it is of great importance not to add too little or too much acetic acid; in the first case, the casein is not completely precipitated, and in the second it is re-dissolved.

W. P. S.

**Composition of Abnormal Milk and Ash Constituents.** SAGORO HASHIMOTO (*J. Sapporo Agric. Coll.*, 1903, 2, 1—14).—The milk was partly curdled and clotted and partly viscous and was strongly alkaline. When examined microscopically, it was found to contain colostrum and blood corpuscles and fragments of tissue. It had a red colour, due no doubt to the presence of blood, since no chromogenic microbes could be detected.

As regards the composition of the milk, the percentages of dry matter, fat, and lactose were found to be very low (especially the fat and lactose); the proteids were high, whilst the total ash was quite normal. The conclusion is drawn that the excess of proteids represents the amounts which, under normal conditions would be utilised for the production of fat and lactose.

The composition of the ash was as follows :

K <sub>2</sub> O.	Na <sub>2</sub> O.	CaO.	MgO	Fe <sub>2</sub> O <sub>3</sub>	P <sub>2</sub> O <sub>5</sub> .	SO <sub>3</sub> .	Cl.
8.96	36.54	7.44	1.74	0.21	17.38	1.34	33.63

The results show that the ash consists largely of sodium chloride and that the amounts of potassium and phosphoric acid are very low. The low percentage of iron indicates that no great amount of blood can be present in the milk. It is probable that a considerable quantity of blood serum had passed into the milk glands.

The milk was from a Dutch cow which had recently calved after an interval of six years since the last calf.

N. H. J. M.

**Origin of Lactose. Effects of Injections of Dextrose during Lactation.** CH. PORCHER (*Compt. rend.*, 1905, 141, 467—469. Compare this vol., ii, 600).—Injection of dextrose gives rise to lactosuria unless the amount is excessive, in which case glycosuria results. The same amount of dextrose which produces lactosuria when the mammary glands are in full activity may produce glycosuria when the glands are less active.

N. H. J. M.

**Physiology of the Kidneys. III. Mechanism of Caffeine Diuresis.** OTTO LOEWI, W. M. FLETCHER, and V. E. HENDERSON (*Chem. Centr.*, 1905, ii, 343; from *Arch. exp. Path. Pharm.*, 53, 15—32).—Caffeine is not a vaso-constrictor; it dilates the kidney vessels, but not those of other organs. The cause of diuresis is accelerated blood-flow. The effect is one directly in the vessel walls and occurs after the nerves have been cut and degenerated. The increased action of caffeine in nephritis fits in with Traube and Cohnheim's theory of that disease.

W. D. H.

**Physiology of the Kidney. IV. Mechanism of Salt Diuresis.** OTTO LOEWI and NATHANIEL H. ALCOCK (*Chem. Centr.*, 1905, ii, 343; from *Arch. exp. Path. Pharm.*, 53, 33—48).—After saline injections, the more watery condition of the blood is the cause of the dilatation of the blood vessels and of diuresis. If the vessels are fatigued by caffeine, salt again causes them to dilate.

W. D. H.

**Physiology of the Kidneys. V. Mechanism of Urea Diuresis.** V. E. HENDERSON and OTTO LOEWI (*Chem. Centr.*, 1905, ii, 343—344; from *Arch. exp. Path. Pharm.*, 53, 49—55).—Here also diuresis is attributed to hydræmia. The paper concludes with a summary of the modes of action of diuretics.

W. D. H.

**A New Compound of Sulphur in Dogs' Urine.** CARL NEUBERG and GROSSER (*Chem. Centr.*, 1905, ii, 835—836; from *Centr. Physiol.*, 19, 316).—Some years ago J. Abel found that on heating dogs' urine with alkali, an alkyl sulphide, probably ethyl sulphide, was split off from an unknown precursor. The latter is of basic nature and can be precipitated from the urine by phosphotungstic acid and isolated from the precipitate by mineral acid and potassium bismuth iodide. The

base is methyl diethylsulphinium hydroxide,  $\text{SMeEt}_2 \cdot \text{OH}$ . The origin of the base appears to be putrefaction of cystine, which leads to the formation of ethyl sulphide, this being subsequently methylated.

W. D. H.

**Cause of the Oxidising Action of Urine.** P. SCHÜRHOFF (*Pflüger's Archiv*, 1905, 109, 83—94. Compare Bertram, this vol., ii, 468).—The oxidising power of urine may be estimated by the following process. The urine, after complete removal of dissolved oxygen, is mixed with 10 c.c. of a sodium hyposulphite solution and the mixture titrated with indigo-carmin solution, a further 10 c.c. of the hyposulphite solution is added, and the titration repeated. The difference between the two readings gives the vol. of standard hyposulphite oxidised by the urine. The hyposulphite must be carefully protected from atmospheric oxygen. The oxidising action is shown to be due to nitrates in the presence of acid phosphates, and only to a slight extent to hydrogen peroxide. The oxidising action can be followed qualitatively by means of ferrous salts without the addition of indigo.

J. J. S.

**Excretion of Nitrogen in the White Rat.** SHINKISHI HATAI (*Amer. J. Physiol.*, 1905, 14, 120—132).—Estimations of the nitrogen excreted by white rats of different ages and weights are given. The following formula gives accurate results:  $\log N = \frac{.233 + (3 \times \log B.W.)}{4}$ , where N is total nitrogen in milligrams per diem and B.W. body weight in grams.

W. D. H.

**Excretion of Ammonia by the Larvæ of Calliphora.** ERNST WEINLAND (*Zeit. Biol.*, 1905, 47, 232—250).—The production of ammonia is a marked feature of the growth of the fly-larvæ. An amino-substance is also formed, the nature of which is uncertain. During the subsequent metamorphosis, ammonia formation ceases. No uric acid was detected until later stages were reached. The relation of these chemical processes to the histolysis which occurs in some of the tissues of the imago is discussed.

W. D. H.

**Scatole.** CH. PORCHER and CH. HERVIEUX (*Zeit. physiol. Chem.*, 1905, 45, 486—497. Compare Abstr., 1905, ii, 187).—If indole is given to an animal it is excreted as indican. It has been held that scatole loses its methyl group and is similarly excreted. As normal urines always contain indican, a bread and milk diet was given. If scatole is given subcutaneously, it passes out as a chromogen, which, on the addition of strong hydrochloric acid, yields a red pigment (scatole-red); this is soluble in amyl alcohol, but not in ether or chloroform. Urine never contains free scatole. Alkalis or reducing agents remove the colour from scatole-red; its spectrum is identical with that of urorosein. In the organism, scatole does not lose its methyl group, and no indican appears in the urine. The chromogen is found in the urine of domestic animals, especially in the ruminants; its occurrence is probably of diagnostic value in disease.

W. D. H.



**Hydrochloric Acid in the Gastric Juice in Cancer.** BENJAMIN MOORE (*Proc. Roy. Soc.*, 1905, 76 B, 138—159).—It is well known that the amount of the acid in gastric juice is lessened or abolished in malignant disease of the stomach. It is now shown that the same is true for cancer of other organs also. This is due to diminished concentration of hydrogen ions in the blood-plasma. The problem of how to maintain it against the competition of the body cells is for the future, for administration of acid below the limits of acid intoxication only calls forth protective ammonia production from the oxidation of proteids.

W. D. H.

**Composition of Blood in Cases of Tuberculosis Pulmonum, Carcinoma Ventriculi, Diabetes Mellitus, Saturnismus Chronicus, and Typhus Abdominalis. Clinical Method for Determining the Plasma Conditions in the Blood in Erythema. Capillary Pyknometer.** FRANZ ERBEN (*Chem. Centr.*, 1905, ii, 783—784).—Results of analyses of blood (proteids, fat, lecithin, cholesterol, and ash constituents) in connection with the various diseases, and the conclusions drawn from them, are given in the original paper (Vienna and Leipzig, 1905).

N. H. J. M.

**Excretion of Leucine and Tyrosine in a Case of Cystinuria.** EMIL ABDERHALDEN and ALFRED SCHITTENHELM (*Zeit. physiol. Chem.*, 1905, 45, 468—472).—Both leucine and tyrosine were found in the urine in a case of cystinuria (a disorder of intermediary metabolism). Future research will indicate whether or not the excretion of these and other amino-acids is a constant feature of the disease. Tyrosine was also found in the urine of an old woman suffering from jaundice.

W. D. H.

**Cystinuria.** EYVIND BÖDTKER (*Zeit. physiol. Chem.*, 1905, 45, 393—404).—Two cases of cystinuria are described in which cadaverine and putrescine were found in the urine. A review of the literature of the subject is given.

W. D. H.

**Feeding on Mono-amino-acids in Cystinuria.** CHARLES E. SIMON (*Zeit. physiol. Chem.*, 1905, 45, 357—358).—A case of cystinuria is recorded in which no diamines were excreted. After the administration of four to five grams of tyrosine, none could be detected in the urine during the next thirty-six hours.

W. D. H.

**Production and Inhibition of Glycosuria in Rabbits by Salts.** MARTIN H. FISCHER (*Pflüger's Archiv*, 1905, 109, 1—25. Compare this vol., ii, 103, and Brown, *Abstr.*, 1904, ii, 273).—The injection of *N*/6 solutions of sodium chloride, bromide, iodide, or nitrate into the veins of the ears of rabbits produces diuresis and glycosuria. Less concentrated solutions intensify renal activity, but produce little or no glycosuria, and the addition of calcium chloride to the sodium salts inhibits the latter phenomenon. Rabbits differ in the readiness with which glycosuria can be produced or inhibited by the

salts, but there is a definite "latent time" before the specific action of the salt is apparent.

The point of activity of all the salts appears to be the *medulla oblongata*.

Lithium, potassium, and strontium chlorides can also produce glycosuria when injected near to the centre of activity, ammonium chloride is without action, and calcium or magnesium chloride produces death.

The action of the salt solutions is not purely osmotic, since solutions of glycerol, carbamide, or ethyl alcohol of the same osmotic concentration do not produce glycosuria.

J. J. S.

**Gout.** HEINRICH KIONKA (*Chem. Centr.*, 1905, ii, 847—848; from *Zeit. exp. Path. Ther.*, 2, 1—9, 9—17, 17—25; ERNST FREY, *ibid.*, 848—849; from *ibid.*, 26—36, 36—45).—On an exclusively flesh diet, hens and other animals develop typical gout. A functional disturbance of liver (failure of urea-forming ferments) and kidneys is an important factor in its causation. Remedies fall into three groups: (1) pain sedatives and purgatives, (2) solvents of uric acid such as piperazine, and (3) specifics such as colchicine and salicylic compounds; the latter act as cholagogues. Glycine is recommended in combination with lithium as likely to form a soluble compound with uric acid.

Frey disputes some of Kionka's views, and regards the giving of glycine as the establishment of a "vicious circle." Glycine and urea hasten the precipitation of neutral urates by addition of sodium hydrogen carbonate, the former because it dissociates hydrogen ions, the latter on account of its basic nature.

W. D. H.

**Digestive Leucocytosis. II. The Source of the Leucocytes.** ALEXANDER GOODALL and DIARMID NOËL PATON (*J. Physiol.*, 1905, 33, 20—33. Compare Abstr., 1903, ii, 669).—The bone-marrow is probably the sole source, and is certainly the only important source, of the cells which constitute digestive leucocytosis.

W. D. H.

**Nephritis.** FRANZ ERBEN (*Chem. Centr.*, 1905, ii, 784; from *Zeit. klin. Med.*, 50).—The chief alteration in the blood in chronic parenchymatose nephritis is the diminution of the albumin and the increase of globulin. The deficient albumin of the cells, due to the poverty of the blood, resulting from the elimination of albumin in the urine, may be considered as the cause of hypertrophy of the heart. The globulin of nephritis urine is, at least in part, normal serum-globulin.

N. H. J. M.

**Chemistry of Malignant Growths. IV. The Pentose-content of Tumours.** S. P. BEEBE and PHILIP SHAFFER (*Amer. J. Physiol.*, 1905, 14, 231—238).—In cancer of the breast, the amount of pentose is usually higher than in normal breast tissue, and is sometimes extremely high in chronic scirrhus where the nuclear proliferation is not a marked feature.

In the tumours of the liver examined, the amount of pentose does not markedly differ from that found in the normal organ; the pentose-

content of normal tissues varies a good deal. Many more observations are necessary before any theory on the relation of cancer and pentose can be considered satisfactory.

W. D. H.

**Potassium and Calcium in Mouse Tumours.** GEORGE H. A. CLOWES and W. S. FRISBIE (*Amer. J. Physiol.*, 1905, 14, 173—192).—In adeno-sarcomata of mice, there is a high percentage of potassium and little or no calcium when the tumours are rapidly growing; but in old, slowly growing tumours the reverse obtains.

W. D. H.

**Studies on Magnesium Salts. I. Anæsthesia by Subcutaneous Injections.** S. J. MELTZER and JOHN AUER (*Amer. J. Physiol.*, 1905, 14, 366—388).—In cats, dogs, frogs and other animals, a certain dose of magnesium sulphate or chloride administered subcutaneously will produce a deep and long-lasting anæsthesia with relaxation of the voluntary muscles and abolition of some of the less important reflex actions. A larger dose leads to death without any symptoms of excitation. No purgative effects were noted. The fall of blood pressure is unimportant. In dogs, local abscesses occurred at the seat of injection, but these healed rapidly.

W. D. H.

**Pharmacology of Ammonium Bases.** HERM. HILDEBRANDT (*Chem. Centr.*, 1905, ii, 501—502; from *Arch. exp. Path. Pharm.*, 1905, 53, 76—87).—As a result of experiments on frogs and rabbits with a number of quaternary coninium bases such as benzylethylconinium iodide, it is found that there is a reduction in toxic properties with increasing molecular weight. The degree of toxicity depends both on the nature and on the spacial arrangement of the groups attached to the nitrogen atom.

P. H.

**Pharmacology of Some Condensation Products of *p*-Aminoacetophenone with Aldehydes.** HERM. HILDEBRANDT (*Chem. Centr.*, 1905, ii, 502; from *Arch. exp. Path. Pharm.*, 1905, 53, 87—90).—The anæsthetic properties of aminoacetophenone are not diminished by condensing this substance with aldehydes containing a phenolic hydroxyl, but are destroyed by condensing with other aldehydes, such as benzaldehyde, tolualdehyde, and cinnamaldehyde.

P. H.

**Influence of Pilocarpine and Atropine on the Circulation through the Submaxillary Gland.** V. E. HENDERSON and OTTO LOEWI (*Chem. Centr.*, 1905, ii, 344—345; from *Arch. exp. Path. Pharm.*, 53, 62—75).—If the *chorda tympani* is stimulated, the vessels of the submaxillary gland enlarge; if atropine is given, this effect is less, not because the dilator nerve-fibres are paralysed, but because secretion falls off. Pilocarpine accelerates the blood-flow and the secretion of saliva; both effects are prevented by atropine. Reasons are given for the deduction that the action of pilocarpine is different to



that obtained by stimulation of the *chorda* nerve endings. The vasodilatation is probably brought about by the action of products due to glandular activity.

W. D. H.

**Chemical Constitution and Diuretic Action in the Purine Group.** PETER BERGELL and PAUL F. RICHTER (*Chem. Centr.*, 1905, ii, 346; from *Zeit. exp. Path. Ther.*, 1, 655—662).—In nephritic rabbits, ethyltheobromine, ethylparaxanthine, and ethyltheophylline act as diuretics. Double salts and other derivatives act similarly, but with different intensities. The intensity of the action depends on the nature of the alkyl residue.

W. D. H.

**Pharmacology of Sulphones.** HERM. HILDEBRANDT (*Chem. Centr.*, 1905, ii, 502—503; from *Arch. exp. Path. Pharm.*, 1905, 53, 90—96).—No alteration in the physiological action of dimethylsulphonedimethylmethane,  $\text{CMe}_2(\text{SO}_2\text{Me})_2$ , is produced by replacing the methyl groups by ethyl. The author has therefore investigated the effect produced on the physiological action by replacement of methyl by other groups. It is found that the propyl group increases the activity, as also to a lesser extent does the isopropyl group. The introduction of the carbonyl group as in 2:2-diethylsulphone pentane-3-one,  $\text{CMe}(\text{SO}_2\text{Et})_2\text{COEt}$ , destroys all hypnotic and other noxious properties of the compounds.

P. H.

**Antagonistic Action of Saponin and Cholesterol.** WALTHER HAUSMANN (*Beitr. chem. Physiol. Path.*, 1905, 6, 567—580).—The injurious action of saponin on blood corpuscles is neutralised by cholesterol. This power of cholesterol is increased by the replacement of the hydroxyl group by chlorine, hydrogen, acetyl, or benzoyl radicles. The breaking up of the double linking in cholesterol by chlorine or hydrogen weakens its action. Phytosterol of different origins is antagonistic to saponin. The cholesterol-saponin reaction of Ransom appears to include substances the cholesterol nature of which is uncertain, and to prove that they belong to this group.

W. D. H.

**Action of Various Nucleic Acids on the Animal Organism.** ALFRED SCHITTENHELM and ERNST BENDIX (*Chem. Centr.*, 1905, ii, 840; from *Zeit. exp. Path. Ther.*, 2, 166—178).—Nucleic acid produces a hypoleucocytotic condition followed by a long hypoleucocytosis. The origin of the acid, whether animal or vegetable, does not matter. Sodium  $\alpha$ -thymonucleate has no action on blood-pressure, but sodium nucleate from yeast causes it to fall; this is probably due to proteid admixture. After intravenous injection, part passes unchanged into the urine and raises the output of purine bases. The least toxic and the one least harmful to the kidneys of the substances used was Bayer's yeast nucleic acid, and this is poorest in purine bases.

W. D. H.

**Action of Unaltered Proteid Solutions on the Leucocytes.** FRIEDRICH HAMBURGER and A. VON REUSS (*Zeit. Biol.*, 1905, 47, 24—40).—The injection into animals of foreign cells and proteids gives rise to the production of anti-substances, and therefore acts like

a poison. In the present research, certain unaltered proteid solutions, like serum, milk, and white of egg, were injected into rabbits, and the number of leucocytes counted in the blood at intervals after the operation. Rabbits' serum and physiological salt solution gave negative results; horse serum produced a little effect; but the serum of other animals, milk, and egg-white produced a marked lowering of the number of white corpuscles, followed in most cases by a rise later. Whether the disappearance of the leucocytes is due to actual destruction or to their accumulation in the capillary areas of organs due to chemotactic influence was not investigated; but whichever is the correct explanation, the occurrence is evidence of a distinct poisonous action.

W. D. H.

**Intravenous Injection of Bone-marrow Extracts.** ORVILLE H. BROWN and CHARLES CLAUDE GUTHRIE (*Amer. J. Physiol.*, 1905, 14, 328—338).—The marrow (mostly yellow marrow was used) contains a substance that depresses blood pressure by dilating the blood-vessels; the substance to which this is due is not destroyed by boiling, but its nature is not yet determined. Bone-marrow thus falls into line with most other tissues. In marrow extracts which have not been heated above the body-temperature, there is also evidence of the presence of a pressor substance.

W. D. H.

**The Transport of Iodised Fat in Phosphorus Poisoning.** H. GIDEON WELLS (*Zeit. physiol. Chem.*, 1905, 45, 412—419).—In rabbits poisoned with phosphorus, the administration of iodised fat leads to an increase in the iodine of liver and kidneys. This is probably due to the fact, not that no transport of fat has occurred, but that, by the action of lipase, the fat first loses its iodine.

W. D. H.

**Localisation of Arsenic.** GEORGES DENIGÈS (*Ann. Chim. Phys.*, 1905, [viii], 5, 559—574. Compare Besredka, *Abstr.*, 1900, ii, 156).—The results of the examination of the various organs in human bodies poisoned by arsenic indicate that, whether the poisoning has occurred slowly or rapidly, the arsenic tends to accumulate in the liver, whilst only small quantities are found in the brain and spinal cord. These results are in direct opposition to those of Scolosuboff (this *Journal*, 1876, i, 92). The latter's observations were made on animals poisoned by means of sodium arsenate, and the author has repeated Scolosuboff's experiments on dogs and rabbits, and finds that in these animals, as in man, the poison accumulates in the liver. It is noteworthy that there is generally, between the right and left kidneys, and always between the right and left lobes of the liver, a marked difference in the amount of arsenic present. Particulars are given in the original of the amounts of arsenic found in various organs in a number of cases of poisoning with this material, and there is also a critical *résumé* of previous work on this subject.

T. A. H.

**The so-called Antitoxic Action of Bivalent Cations.**

WILLIAM A. OSBORNE (*Proc. physiol. Soc.*, 1905, x—xii; *J. Physiol.*, 33).—*Fundulus ova* develop in distilled water, but not in pure sodium chloride solutions. If calcium salt is added to the latter, development proceeds normally. From such data, Loeb infers that sodium ions are toxic, whilst calcium (or strontium) ions are antitoxic. A simpler explanation is that in excess of sodium chloride the whole of the calcium in the cell-protoplasm will be eventually replaced by sodium, a change which must profoundly affect the protoplasm; but if calcium and sodium are both present in the outer fluid, the relative concentrations of calcium and sodium in the cell remain unaltered. Some experiments recorded with milk confirm this view. An *iso*-physiological solution must therefore be not only isotonic with the cell contents, but also after it has passed the cell-wall must have its ions in such concentration as to cause no change in the physiological salts and ions within the cell.

W. D. H.

**Detection of Hydrocyanic Acid.**

ANGELO DE DOMINICIS (*Chem. Centr.*, 1905, ii, 265—266; from *Boll. Chim. Farm.*, 44, 337—340).—Working with large animals, hydrocyanic acid can be detected in the blood and organs after it has been administered in various ways. This is contrary to the conclusions of Ganassini (*Boll. Chim. Farm.*, 43, 715).

W. D. H.

**The Toxicity of the Normal Intestinal Contents.**

ERNST MAGNUS-ALSLEBEN (*Beitr. chem. Physiol. Path.*, 1905, 6, 503—523).—The contents and mucous membrane of the upper part of the small intestine of animals fed on flesh, and probably also on bread, fat, and starch-meal, but not on milk or milk-proteid, contain a poisonous substance which, on intravenous injection into rabbits, causes paralysis of the central nervous system and convulsions. Death is due to respiratory stoppage. If the injection is made into the portal vein, the action does not occur, at any rate, with the same doses. The poison is destroyed by boiling in an acid solution. In all regions of the intestine, a substance is also found which lowers blood-pressure; this is not neutralised by passage through the liver, but is destroyed by boiling in an acid solution.

W. D. H.

**Thalassin, the Poison of Sea Anemones.**

CHARLES RICHET (*Pflüger's Archiv*, 1905, 108, 369—388).—The poison extracted from the tentacles of sea-nettles (anemones) is soluble in 95 per cent. alcohol, and is not destroyed by heat. It is widely distributed in marine animals, and in doses of a thousandth part of a milligram produces poisonous effects of which the most marked is congestion. In large doses, it causes paralysis of the heart. The poison, however, consists of two substances, one of which, named *congestin*, on injection renders an animal more sensitive to the toxic effects, whilst the other, *thalassin*, is of the nature of an antitoxin and produces a certain degree of immunity.

W. D. H.



**Antibacterial Sera.** W. M. CROFTON (*J. Hygiene*, 1905, 5, 444—450).—There is in inactive immune serum a substance corresponding with immune-substance. A like substance is present in normal serum and in that of patients in an early stage of immunisation. The micro-organism is prepared for phagocytosis by the interaction of two substances, one heat-labile (complement), the other heat-stable (immune-substance). An inactive immune serum is of use in treatment provided the complement is present in the patient's blood-plasma. W. D. H.

**Preparation of Cholera Toxin.** BRAU and DENIER (*Compt. rend.*, 1905, 141, 397—400).—Vibrios isolated from cholera excreta are capable of furnishing a soluble toxin. The toxin is rendered more active and its production more certain by the introduction of albumins in the cultures of the vibrios. N. H. J. M.

**Physical Chemistry of the Toxin-Antitoxin Reaction, with Special Reference to the Neutralisation of Lysin by Antilysin.** J. A. CRAW (*Zeit. physikal. Chem.*, 1905, 52, 569—586).—Megatherium lysin (see Todd, *Abstr.*, 1902, ii, 464) passes through a gelatin filter, and can diffuse through gelatin. Megatherium antilysin, on the other hand, does not pass through a gelatin filter, and cannot diffuse through gelatin to any appreciable extent. Filtration and diffusion experiments show that there is free lysin in neutral mixtures of lysin and antilysin, and also in mixtures containing excess of antilysin; further, there is free antilysin in neutral mixtures and also in those containing excess of lysin. The reaction is reversible to some extent when excess of antilysin is present; false equilibria, however, may occur when lysin is present in excess. The neutralisation equation given by Arrhenius and Madsen is not applicable to the case under consideration. The removal of lysin from a solution by antilysin cannot be treated as a purely chemical process. It is closely analogous, however, to certain adsorption phenomena. J. C. P.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Decomposition of Vegetable Foods by Bacteria.** JOSEF KÜNIG (*Bied. Centr.*, 1905, 34, 698—700; from *Hannov. Land-u. Forstwirtschaftl. Zeit.*, 1904, 37, 627. Compare *Abstr.*, 1903, ii, 386 and 447, and this vol., ii, 472).—In the putrefaction of cotton-seed meal, the non-nitrogenous extract substances and pentosans were chiefly attacked. The nitrogenous matter underwent less complete destruction, the proteids being converted into albumoses, peptones, bases, amides, and ammonia. The fat was least attacked.

N. H. J. M.

**Action of Dextrose on the Lactose fermenting Organisms of Faeces.** ARTHUR HARDEN (*J. Hygiene*, 1905, 5, 488—493).—*Bacillus coli communis* attacks dextrose in a characteristic way, each molecular proportion of sugar yielding half a molecular proportion of acetic acid, and of alcohol, one molecular proportion of lactic acid, together with small amounts of succinic acid, carbon dioxide, and hydrogen. In view of MacConkey's division of the lactose-fermenting organisms of the intestine into four groups according to their action on sucrose and dulcitol (Abstr., 1905, ii, 601), the present research was undertaken, and it was found that they may be divided into two groups, those which produce alcohol and acetic acid in equal molecular proportion, and those which produce more than 2.5 molecular proportions of alcohol to one of acetic acid. How this fits in with MacConkey's classification is pointed out. *B. lactis aerogenes* acts on dextrose in a totally different way. W. D. H.

**Bacteriology of Infectious Gastro-enteritis.** HENRI POTTEVIN (*Ann. Inst. Pasteur*, 1905, 19, 426—448).—A species of bacterium, *Bacillus H.*, has been isolated from a ham, the eating of which had produced serious illness. Cultures have been grown in various media, including one with crystal-violet as a component. The effects of such cultures on guinea-pigs, white and grey mice, rabbits, pigeons, pigs, &c., have been studied. The organism can ferment dextrose and mannitol, yielding hydrogen, carbon dioxide, ethyl alcohol, acetic and succinic acids, and large quantities of *l*-lactic acid.

The products obtained by the fermentation of dextrose with *Bacillus enteriditis*, *B. paratyphique* and the bacterium of swine fever are the same as with the bacterium already mentioned. All three organisms are capable of fermenting maltose, dextrose, galactose, mannitol, dulcitol, and, to a certain extent, glycerol. Erythritol, lactose, and sucrose are not fermented.

All the organisms are grouped with the bacilli of swine fever under the generic name *Salmonella* suggested by Lignières. J. J. S.

**Isolation of Bacillus Typhosus from Infected Water.** H. S. WILLSON (*J. Hygiene*, 1905, 5, 429—443).—The importance of being able to isolate and identify in suspected water the bacillus of typhoid fever is obvious. A new precipitation method is described. The water itself should also be made a nutrient medium by the addition of caffeine (Hoffmann and Ficker), so that the organism multiplies at the expense of others and can thus be detected readily. W. D. H.

**Action of Radium Emanations on Pathogenic Bacteria.** ERNST DORN, EUGEN BAUMANN, and SIEGFRIED VALENTINER (*Chem. Centr.*, 1905, ii, 841—842; from *Physikal. Zeit.*, 6, 497—500).—Typhoid bacilli are very sensitive to the direct action of radium emanations, but in cultures in gelatin those 2 mm. below the surface are protected. If the emanations are blown through bouillon cultures, their bactericidal action occurs slowly. The same is true for cholera, diphtheria, and other pathogenic organisms. The  $\beta$ -rays are the most harmful.

W. D. H.

**Bacteria which are Active in the Maceration of Flax.** MARTINUS W. BEYERINCK and A. VAN DELDEN (*Chem. Centr.*, 1905, ii, 843—845; from *Arch. Néerland.*, [ii], 9, 418—441).—The object of maceration is to soften the stems by partial solution and by removing the "pectose." The latter is a calcium compound related to cellulose, the organic acid of which is a substance of the formula  $(C_6H_{10}O_5)_n$  or  $(C_{12}H_{22}O_{11})_m$ , united with, perhaps, gluconic acid. By treatment with acid, "pectose" yields pectin and metapectin. Pectin gelatinises in presence of lime and pectase, whilst metapectin does not. By further hydrolysis, pectin yields galactose and pentose, other kinds dextrose and arabinose. Both pectose and pectin yield mucic acid when boiled with nitric acid.

The active bacterium in maceration is a granulo-bacterium, *G. pectinovorum*, which dissolves the pectose without injuring the fibre. Its activity is due to a special enzyme, *pectosinase*, which converts pectose successively into pectin and sugar, the bacterium fermenting the sugar with production of hydrogen, carbon dioxide, and a little butyric acid.

The growth of *G. pectinovorum* depends not only on a limited access of air, but also on the previous removal of soluble nitrogenous compounds by immersion of the flax for 24 hours in running water. The temperature should be 28—35°.

The bacterium ferments dilute must, in absence of air, without producing butyric acid. It does not ferment inulin, mannitol, erythritol, glycerol, or gum arabic, but ferments dextrose, lævulose, galactose, lactose, and maltose with peptone, not, however, with ammonia as the source of nitrogen. *G. urocephalum* ferments all kinds of carbohydrates in presence of ammonia. N. H. J. M.

**Diastases in Wine Diseases** PHILIPPE MALVEZIN (*Chem. Centr.*, 1905, ii, 347; from *Bull. Assoc. Chim. Sucr. Dist.*, 22, 1064—1068).—The micro-organisms which cause diseases of wine, especially *Mycoderma aceti*, *Micrococcus oblongus*, and the mannitol ferment, act probably by means of enzymes specific in causing certain diseases. The two first named produce from dextrose gluconic acid and oxygluconic acid, that is, exert an oxidising action. In lactic fermentation, two molecules of lactic acid arise from one of dextrose, which is regarded as a simple splitting of the molecule, and the name *Pastorase* is suggested for the enzyme. The mannitol fermentation  $(C_6H_{12}O_6 + H_2 = C_6H_{14}O_6)$  is due to a *hydrolase*. W. D. H.

**Sterigmatocystis Nigra and Oxalic Acid.** P. G. CHARPENTIER (*Compt. rend.*, 1905, 141, 367—369 and 429—431).—*Sterigmatocystis nigra* produces oxalic acid when cultivated in Raulin's liquid, and in the same liquid when the tartaric acid is replaced by sulphuric acid. Oxalic acid is not formed when tartaric acid is the only source of carbon.

Cultivations of *Sterigmatocystis* in Raulin's liquid only secrete oxalic acid when sporulation commences. This is due to the exhaustion of the solution. N. H. J. M.



**Lactic Acid Fermentation.** E. KAYSER (*Bied. Centr.*, 1905, 34, 701—709; from *Ann. inst. nat. agron.*, [ii], 3, 241).—A ferment is described which assumes various shapes, occurring in spherical forms and in the form of bacilli. It is characterised by the production of ethyl alcohol and mannitol. It is not a real lactic acid ferment, as the amount of lactic acid produced is not more than 70—75 per cent. of the weight of the sugar employed. Both inactive and lævorotatory acids are produced.

Two other ferments are described which yield the dextrorotatory acid, and one which produces the inactive acid. N. H. J. M.

**Assimilation of Free Elementary Nitrogen by Micro-organisms.** J. VOGEL (*Centr. Bakt. Par.*, 1905, 15, ii, 174—188 and 215—227; this vol., ii, 646).—A *résumé* of the recent investigations on the subject. N. H. J. M.

**Loss of Nitrogen in Putrefying Peptone Solutions. Bacteriological Soil Investigation.** PAUL EHRENBURG (*Centr. Bakt. Par.*, 1905, 15, ii, 154—164).—The loss of nitrogen in putrefying peptone solutions which have been inoculated with soil and then filtered is due more to absorption than to biological fixation in the soil.

In determining the power of soils to produce putrefaction in peptone solutions, it is necessary to make determinations in the whole contents of the flasks, and to avoid filtration and the use of portions of the solution.

Similar soils, which have been subjected to different treatments, show appreciable differences in their putrefying power. N. H. J. M.

**Vegetable Assimilation and Respiration. IV. Carbon Dioxide Assimilation and Leaf Temperature.** F. FROST BLACKMAN and GABRIELLE L. C. MATTHAEI (*Proc. Roy. Soc.*, 1905, 76 B, 402—460).—Three factors control the amount of assimilation of carbon dioxide by a leaf: (1) intensity of illumination, (2) temperature of the leaf, and (3) pressure of the gas in the surrounding air. The present work is an attempt to interpret the quantitative variations in terms of the three factors. Differences are noted between leaves of different plants in their coefficients of acceleration of assimilation activity with increase of temperature. There is no optimum intensity of light for assimilation, but equal intensities incident upon equal areas of different leaves produce equal amounts of assimilation. W. D. H.

**Pure Culture of Green Plants, in a Confined Atmosphere, in Presence of Organic Matters.** MOLLIARD (*Compt. rend.*, 1905, 141, 389—391. Compare *ibid.*, 1904, 139).—When a plant is grown in a solution containing 10—15 per cent. of dextrose, the decomposition of carbon dioxide is four times as great (for the same leaf-surface) as with a purely mineral solution.

In cultures containing asparagine in addition to dextrose, there is a much greater absorption than when dextrose alone is supplied.

In absence of light, the absorption of sugar is very small.

N. H. J. M.

**Different Origin of the Carbon Dioxide given off by Plants during Respiration.** WLADIMIR PALLADIN (*Chem. Centr.*, 1905, ii, 639; from *Ber. deut. bot. Ges.*, 23, 240—247).—The carbon dioxide given off by plants is attributed to different sources. (1) Nucleo-carbon dioxide produced by enzymes united with the protoplasm; (2) from protoplasm under the influence of various irritants, and (3) oxydase-carbon dioxide produced by catalase and oxydase, &c.

It was found that the elimination of carbon dioxide increases with the amount of protoplasm. Sap from bulbs of *Gladiolus Lemoinei* which gives off only traces of carbon dioxide, produces considerable amounts of the gas when hydrogen peroxide is added. Pyrogallic acid produces a similar effect.

N. H. J. M.

**Effect of Carbon Dioxide on Geotropic Curvature of the Roots of *Pisum Sativum*.** ERIC DRABBLE and HILDA LAKE (*Proc. Roy. Soc.*, 1905, B, 76, 351—358).—When roots are placed horizontally in boiled water or in hydrogen or other indifferent gas, they fail to respond to geotropic stimulus. When removed from the boiled water and placed vertically in air, the root curves in the direction of the previous stimulus.

The object of the experiment now described was to ascertain the effect of carbon dioxide on geotropic curvature. The roots, in a horizontal position, were subjected to the action of air containing various amounts of carbon dioxide for different lengths of time and then placed in a klinostat, which revolved once in 19 minutes, so that the axis of the root was parallel to the axis of rotation. The first appearance and extent of the earlier curvatures were then observed. In air and with amounts of carbon dioxide up to 3 per cent., all the roots finally showed large curvatures, whilst with 7.5 and 10 per cent. of carbon dioxide the actual power of response was greatly diminished as well as delayed. The measurements of the curvatures observed after 30 minutes and at intervals up to three hours are given in tables.

It is considered that the effects produced may not improbably be attributed to the positive or negative ion ( $H^+$  or  $HCO_3^-$ ) of dissociated carbonic acid.

N. H. J. M.

**Lime Requirements of Plants.** OSCAR LOEW (*Bied. Centr.*, 1905, 34, 651—654; from *Landw. Jahrb.*, 1905, 34, 131—137).—An excess of calcium in plants is in most cases rendered harmless by conversion into oxalate, whilst an excess of magnesium will retard growth.

Soils which contain approximately the same amounts of calcium and magnesium are most suitable for cereals. In the case of leaf crops, an excess of calcium over magnesium (2—3 : 1) is desirable.

N. H. J. M.

**Lime Requirements of Various Vegetable Organs.** OSCAR LOEW (*Chem. Centr.*, 1905, ii, 412—413; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 8, 603—608).—According to Wolff's tables, barley and peas (without the roots) contain far more calcium than magnesium, especially in the leaves. The roots contain much less calcium than the leaves, but usually contain a good deal more calcium than magnesium. The seeds alone show an excess of magnesium.

It has been found that the roots grow much more in presence of an excess of magnesium than with an excess of calcium, whilst the stems and leaves diminish. N. H. J. M.

**An Electrical Response to Excitation in *Desmodium Gyans*.** FLORENCE BUCHANAN (*Proc. Physiol. Soc.*, 1905, viii—x; *J. Physiol.*, 33).—A study of the electrical changes which occur on stimulating the stipellæ of the leaflets. The rate of propagation of the change has not yet been studied. Cells with protoplasmic connections capable of conducting impulses in the direction of the fibro-vascular bundles were found by Haberlandt in *Mimosa*. Similar appearances are found in *Desmodium*. The characteristic leaf-movements in the latter can be induced in an inactive plant by supplying the roots with water containing 0.05 per cent. of ammonia. Stahl explains the movement by regarding it as an adaptation for increasing transpiration and supplying nutritive salts to the leaves. The supply of nutrient and other solutions, however, appears more likely to be the cause rather than the effect of the movement. W. D. H.

**Reactions of Living Cells to Dilute Solutions of Heavy Metallic Salts.** THOMAS BOKORNY (*Chem. Centr.*, 1905, ii, 833; from *Pharm. Centr.-H.*, 46, 605—609. Compare Abstr., 1905, ii, 476).—Work on the same lines as previously published, special attention being paid to the action of salts of copper, mercury, and silver.

After exposure of *Spirogyra* and other cells to the action of dilute silver nitrate, the position of the silver compounds formed can be subsequently localised microscopically by treatment with hydrochloric acid and hydrogen sulphide, or sunlight. W. D. H.

**Existence in Red-currants of a Compound yielding Hydrogen Cyanide.** L. GUIGNARD (*Compt. rend.*, 1905, 141, 448—452. Compare this vol., ii, 604).—Leaves of red-currants yield hydrogen cyanide at all periods of vegetation, but the amount is always small, being 0.0035 per cent. in the middle of June, 0.0026 per cent. some weeks later, and 0.0015 per cent. at the beginning of August; the young twigs yield very little and the roots none at all.

Leaves of *Ribes aureum* also yield hydrogen cyanide, but in smaller quantity than red-currants. Negative results were obtained with leaves of *Ribes nigrum*, *R. Uva-crispa*, *R. sanguineum*, *R. multiflorum*, *R. subvestitum*, *R. prostratum* and *R. Gordonianum*. N. H. J. M.

**Coto Bark.** OSWALD HESSE (*J. pr. Chem.*, 1905, [ii], 72, 243—248. Compare Jobst and Hesse, Abstr., 1880, 325; Hesse, Abstr., 1895, i, 110; Ciamician and Silber, *ibid.*, i, 554).—The author describes a new coto bark which comes from the same district of Bolivia as the true coto bark, but does not contain cotoin. It has a pleasant, aromatic odour, and when treated with ether yields benzoic acid and a neutral substance, *cotellin*,  $C_{18}H_{16}O_4(OMe)_2$ . This crystallises in glistening, tetragonal, double pyramids, or from dilute alcohol in colourless leaflets, has no taste, melts at 169°, and decomposes at a few degrees higher. It is moderately soluble in hot alcohol, ether, acetone, or glacial acetic acid, and dissolves easily in chloroform or benzene. It



does not dissolve in dilute alkali hydroxides or acids, but with concentrated sulphuric acid forms a yellow solution which becomes brownish-black; it evolves red vapours and forms oxalic acid and a yellow, resinous mass when warmed with concentrated nitric acid, and yields a bluish-green substance when heated with concentrated potassium hydroxide.

With bromine in chloroform solution, cotellin forms a tetrabromo-derivative,  $C_{20}H_{16}O_6Br_4$ , which crystallises in small, white needles, and melts and decomposes at  $220^\circ$ ; when treated with concentrated sulphuric acid it becomes yellow, and when warmed, black, and it forms a brownish-black mass when evaporated with aqueous potassium hydroxide.

When warmed with acetic anhydride at  $85^\circ$ , the crystalline cotellin is converted into an amorphous modification which melts at about  $80^\circ$ .

G. Y.

**Proteids of the Castor Bean; Isolation of Ricin.** THOMAS B. OSBORNE, LAFAYETTE B. MENDEL, and ISAAC F. HARRIS (*Amer. J. Physiol.*, 1905, 14, 259—286).—The proteids are like those of other oil-beans, and consist of a crystallisable globulin, a smaller amount of coagulable albumin, and proteoses. Ricin is believed to be identical with the albumin; a new method for isolating it to study its agglutinating and toxic characters (which are very powerful) is given.

W. D. H.

**The Hydrolytic Enzyme, Lipase.** FREDERICK L. DUNLAP and WILLIAM SEYMOUR (*J. Amer. Chem. Soc.*, 1905, 27, 935—946).—Four seeds were examined in a resting state and two of them in a germinated condition. Flax, pea-nut, croton, and almond seeds are not hydrolytic, or only very slightly so in a resting state, and the zymogen is not rendered active by the means utilised for castor-oil bean, celandine, and toad-flax.

Lipase is produced during the germination of flax and pea-nut, and active solutions were prepared. It is probable that the lipase differs from that of the bean; the solutions, both from flax and from pea-nut, are precipitated by alcohol, but whilst the precipitate in pea-nut lipase shows marked lipolytic power, that in flax lipase solutions does not.

N. H. J. M.

**Cause of the Presence of Abnormal Amounts of Starch in Bruised Apples.** G. WARCOLLIER (*Compt. rend.*, 1905, 141, 405—408).—When apples are bruised, the tannin coagulates the amylase, and thus prevents the transformation of starch into fermentable sugars.

N. H. J. M.

**Dampness of Grain.** J. E. HOFFMANN (*Bied. Centr.*, 1905, 34, 688—692; from *Wochens. Brau.*, 1905, No. 18).—Wetness of grain is due to conditions of weather, the moisture deposited on the cold grain from warm and damp air being rapidly absorbed, and to respiration. The water thus absorbed is given off later on when the weather becomes warmer.

Absorption of water results in the production of maltose, whilst elimination of water gives rise to production of starch (compare Grüss, *Woch. Brau.*, 1899, 519).

N. H. J. M.

**Development of Rye and Wheat.** BERNHARD SCHULZE (*Bied. Centr.*, 1905, 34, 602—610; from *Landw. Jahrb.*, 1904, 405).—By the end of the winter, rye had assimilated nearly half of the final amount of nitrogen, whilst in the case of wheat, assimilation of nitrogen took place chiefly from the beginning of April to the commencement of grain production. It is therefore desirable to provide rye with soluble nitrogen during winter. Both crops would have plenty by the beginning of spring. Phosphoric acid is chiefly taken up during spring growth by rye and until after flowering by wheat. Both rye and wheat take up certain amounts of potassium in the winter, but chiefly at the time of the greatest production of carbohydrates. Calcium and magnesium are less in demand by the young plants and are probably, like silica, of more importance later on, in connection with the solidification of the tissues. N. H. J. M.

**Variability of Wheat Varieties in Resistance to Toxic Salts.** L. L. HARTER (*Bureau of Plant Industry, Bul.* 79, *U.S. Dept. Agr.*, 1905).—The salts with which experiments were made are injurious to wheat seedlings in the following order: magnesium sulphate, magnesium chloride, sodium carbonate, sodium hydrogen carbonate, sodium sulphate, sodium chloride. In the case of other plants, the order may be different. Wheat is one and a half to six times as resistant as white lupins; the least difference is with sodium carbonate and the greatest with magnesium sulphate and sodium hydrogen carbonate.

Different varieties of wheat, representing extremes, vary in the ratio 1 : 3 in their power of resistance; but varieties which as a whole are the most resistant are not always the most resistant to every salt. Similarly, the generally least resistant is not necessarily the least resistant to each salt.

All the salts employed, except sodium carbonate and chloride, act as stimulants in dilute solutions. Pure water does not hinder development, but traces of zinc will kill the root-tips in 24 hours.

N. H. J. M.

**Durum Wheat.** F. A. NORTON (*J. Amer. Chem. Soc.*, 1905, 27, 922—934).—The amount of proteids in Durum wheat is much higher than in bread wheats, and tends to increase under American conditions of soil and climate. The wheat is especially rich in sucrose and dextrose; the gluten is high, but of rather poor quality, being deficient in gliadin. This deficiency seems, however, to be compensated for in the best wheats by greater amounts of gluten. The best Durum wheats are very suitable for bread and macaroni. N. H. J. M.

[Pot-culture Experiments on the Influence of the Iodides and Oxides of Manganese, Potassium, Sodium, and Lithium on Wheat and Barley.] JOHN A. VOELCKER (*Jour. Roy. Agric. Soc. Engl.*, 1904, 65, 306—314).—The salts were mixed with the last four pounds of the soil used in filling the pots so as to avoid possible removal beyond the reach of the roots in their early stages.

Manganese, potassium, sodium, and lithium are injurious to wheat when applied at the rate of 1 cwt. per acre, and to barley when 2 cwt. per acre are applied. In the case of wheat, the manganese salt is the most injurious. The corresponding oxides, especially lithium oxide, are beneficial to wheat when applied at the rate of 2 cwt. per acre. With the exception of lithium oxide, which is possibly beneficial, the oxides had no effect on barley.

The results of water-culture experiments on barley with lithium and manganese iodides and oxides (0.1 to 0.2 gram per litre) show that the iodides are poisonous, and that the oxides are without much effect. Manganese salts produce long, wiry roots, whilst lithium salts give rise to thick, stunted roots.

N. H. J. M.

**Influence of the Composition of Barley on the Development, Quality, and Productivity, and on the Transmission of these Properties.** JOHANN VAÑHA, OTTO KYAS, and JOSEF BUKOVANSKY (*Chem. Centr.*, 1905, ii, 695—696; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 8, 667—684).—The yield of barley increases with the amounts of non-nitrogenous extract substances and soluble proteids in the seeds. A high percentage of extract in the seed is favourable to the lengthening of the stems, whilst the number of ears increases with the soluble proteids of the seed.

Seeds with high amounts of extract and of proteids do not yield crops with high extract and high proteid.

N. H. J. M.

**Pot Experiments to Determine the Limits of Endurance of Different Farm-crops for Certain Injurious Substances.** FREDERICK B. GUTHRIE and R. HELMS (*Agric. Gaz. N. S. Wales*, 1905, 16, 853—860. Compare *ibid.*, 1903, 14, 114, and 1904, 15, 29).—Barley and rice were grown in a mixture of garden loam and sand, to which superphosphate and varying amounts of sodium chloride, sodium carbonate, sodium chlorate, and arsenious oxide respectively were added. The results are summarised in the following table, in which the numbers indicate percentages of the different substances employed :

		NaCl.	Na <sub>2</sub> CO <sub>3</sub> .	NaClO <sub>3</sub> .	As <sub>2</sub> O <sub>3</sub> .
Germination affected	{ barley	0.1	0.25	0.005	—
	{ rice	0.1	0.25	0.004	0.2
Germination prevented	{ barley	0.25	0.60	0.007	0.6
	{ rice	0.40	0.50	0.006	0.4
Growth affected	{ barley	0.10	0.15	0.003	0.05
	{ rice	0.15	0.25	0.002	0.15
Growth prevented	{ barley	0.20	0.40	0.006	0.10
	{ rice	0.20	0.40	0.004	0.30

N. H. J. M.

**Plant Analysis as an Aid in Estimating the Manurial Requirements, with Special Reference to Hops.** PH. SCHNEIDER (*Chem. Centr.*, 1905, ii, 970—971; from *Woch. Brau.*, 22, 456—458).—The amount of phosphoric acid in the more advanced leaves of hops



shows a definite minimum, about 0.5 per cent. in the lower leaves, when phosphoric acid is deficient in the soil. At the time of the first crop, the lower leaves showed the optimal stage of development, whilst at the time of the second crop the upper leaves reached the stage at which a deficiency of phosphoric acid is best observed.

The amount of nitrogen in hops follows that of phosphoric acid, and the deficiency or otherwise of nitrogen in the soil is best detected by the composition of the leaves. No definite results can, however, be obtained in the case of potassium, magnesium, and calcium.

N. H. J. M.

**Ripening of Peaches.** WILLARD D. BIGELOW and HERBERT C. GORE (*J. Amer. Chem. Soc.*, 1905, 27, 915—922).—The samples were collected (1) in June, after all the imperfect fruit had fallen off; (2) when the stone had hardened; and (3) when ripe for the market. The average weights (six varieties) at the three periods were 9.51, 16.75, and 73.59 grams, and the weights of flesh were 6.12, 11.89, and 68.11 grams respectively.

The percentage composition of the flesh was as follows:

	Solids.	Reducing sugar.	Sucrose.	Acid (as $H_2SO_4$ ).	Proteids.	Amides.	Ash.
1.	14.77	2.71	0.18	0.28	0.77	0.21	0.75
2.	16.97	2.26	1.57	0.34	0.63	0.18	0.68
3.	14.04	1.98	5.70	0.56	0.27	0.08	0.40

N. H. J. M.

**Etherisation as an Aid in Rhubarb Forcing.** WILLIAM STUART (*17th Ann. Rep. Vermont Agric. Exper. Stat.*, 1903—1904, 442—445).—The plants were dug up late in the autumn and subjected to frost in the usual manner, in a cold frame. The first lot was placed in a cool cellar to thaw and subjected to ether (10 c.c. per cubic foot of air) for 48 hours (Dec. 20). The plants were then placed in a darkened greenhouse having a temperature of 45—65°. Three other lots were etherised on Jan. 9, Jan. 30, and Feb. 24 respectively.

The results of experiments 1, 2, and 4 showed a gain of 622 per cent. in the first cutting, and of 86, 23, and 47 per cent. in the second, third, and fourth cuttings respectively, due to etherisation. It is probable that still greater increase would be obtained by treating with ether at a still earlier date.

In the third experiment, a larger amount of ether (17 c.c. per cubic foot of air) was employed: the results were much less satisfactory.

N. H. J. M.

**Cultivation of *Solanum Commersoni* at Verrières (Vienne, France).** LABERGERIE (*Bied. Centr.*, 1905, 34, 616—622; from *Jour. d'Agr. prat.*, 68, 631, 665, 803, and 831).—The original plant brought by Heckel in 1901 from Uruguay has yellowish-white, egg-shaped tubers, having a very bitter taste. By cultivation, an edible variety has been obtained, equal at least to potatoes. It is better

able to resist disease than potatoes, yields larger crops, and is more nutritious. The average yield of starch is 15,000 kilos. per hectare.

The composition of tubers grown on good soil was as follows: water, 72.59; starch, 19.91; sugar, 0.114; fat, 0.022; and crude fibre, 0.639 per cent.

N. H. J. M.

**Results of Experiments on the Action of Phosphoric Acid on Sugar Beet.** HERMANN RÖMER (*Chem. Centr.*, 1905, ii, 851; from *Zeit. Ver. Rüben-Zucker-Ind.*, 1905, 764—774).—The experiments were made in a mixture of sand and peat. Without phosphoric acid, the average weight of the roots was 0.36 gram, and they contained 6.5 per cent. of sugar. The leaves were dark green. With very small amounts of phosphoric acid, the roots weighed 24 grams and contained 14.3 per cent. of sugar. The amount of phosphoric acid required is probably between 0.568 and 1.065 grams per root; or 12.5 to 19 kilos. per morgen to obtain a yield of 200 cwt.

N. H. J. M.

**Feeding and Metabolism of Agricultural Animals.** FRANZ TANGL (*Bied. Centr.*, 1905, 34, 671—692; from *Landw. Jahrb.*, 1905, 1—92).—*Sorghum* [with STEPHAN WEISER and ARTHUR ZAITSCHEK].—The available chemical energy of sorghum is, for bullocks, 59.7; sheep, 56.5; horses, 61.8; pigs, 68.7; ducks, 46.7; and geese, 57.1 per cent. In the case of bullocks, the utilisation is less when more than 6 kilos. per 1000 kilos. of live weight is given. It gave better results (although less economical) than maize for fattening cows. For horses, a mixture of oats (2) and sorghum (1 part) is recommended. It is a suitable food for pigs, geese, and turkeys, but not for poultry and ducks.

**Composition and Nutritive Value of Oats** [with MICHAEL KORBULY and STEPHAN WEISER].—The amounts of constituents of oats digested by (1) horses and (2) sheep are as follows:

	Organic matter.	Crude protein.	Crude fat.	Crude fibre.	Non-nitrog. extract.	Pentosans.	Energy per kilog.
1.	50.58	7.76	3.22	0.78	38.82	1.68	2421 Cal.
2.	56.20	7.25	3.73	4.41	40.81	4.00	2660 „

Of the total energy of oats, horses utilise 54.8 and sheep 53.85 per cent. The weight per hectolitre of oats has no relation to the composition.

N. H. J. M.

**Effect of Asparagine on the Production of Milk and its Constituents.** THEODOR PFEIFFER, A. EINECKE, and W. SCHNEIDER (*Mitt. landw. Inst. k. Univ. Breslau*, 1905, 3, 179—225).—The partial substitution of proteids, in a ration moderately rich in proteids, by a caloric equivalent mixture of asparagine and sucrose did not diminish the yield of milk; in some cases there was, perhaps, an increase. The percentage and absolute amount of milk fat was diminished, and there was a reduction in the percentage of proteids and dry matter, but no essential change in the absolute amount of proteids. The substitution acted unfavourably on the increase in live-weight.

The conclusion is drawn that amides should not be considered as nutritive substances, although in very nutritive rations they act, in some unexplained manner, as stimulants, and are favourable to milk production at the expense of other constituents of the food and body.

N. H. J. M.

**Sterilisation of Milk with Hydrogen Peroxide, with Special Reference to Budde's Process.** MSTISLAW LUKIN (*Centr. Bakt. Par.*, 1905, 15, ii, 165—174. Compare this vol., ii, 647).—Hydrogen peroxide is more active in neutral or slightly alkaline solutions than in acid solutions; ordinary solutions should therefore be neutralised when used. The temperature 52° (Budde) is the most favourable, and in most cases 12 c.c. of 3 per cent. hydrogen peroxide is sufficient for 1 litre of milk.

The objections to Budde's process are the small amounts of unchanged hydrogen peroxide in the sterilised milk and the presence of injurious substances (arsenic and barium chloride) in ordinary preparations of hydrogen peroxide. The consumption of the sterilised milk is not known to have had injurious effects; it is, however, desirable that the changes which are known to occur in the proteids should be further investigated.

N. H. J. M.

**Comparative Experiments on Chemical Preservatives in Milk.** HENRY C. SHERMAN, ALBERT W. HAHN, and ARTHUR J. METTLER (*J. Amer. Chem. Soc.*, 1905, 27, 1060—1068).—Milk kept at 20—25° without preservative rapidly lost lactose and gained in acidity during the first three to six days; the destruction of lactose then proceeded more slowly, but the formation of acid had not ceased entirely after four weeks.

0.1 per cent. of hydrogen peroxide, sodium fluoride, sodium salicylate, or a mixture of equal parts of boric acid and borax distinctly diminished the development of acidity in milk. Except in the case of hydrogen peroxide, which rapidly disappears, the amount of added preservative can be determined with a fair degree of accuracy by the usual methods. In the case of fluoride or salicylate preservative, the occasional opening of the bottles led to irregular results. For details, the tables contained in the original paper should be consulted.

L. DE K.

**Classification and Nomenclature of Arable Soils according to their Mineral Constitution.** H. LAGATU (*Compt. rend.*, 1905, 141, 363—366. Compare this vol., ii, 557; and Delage and Legatu, *Constitution de la terre arable*, Montpellier, 1904).—A graphic method for the representation of the amounts of chalk, clay, and sand is described.

N. H. J. M.

**Diffusion in Acid and Neutral Media, especially in Humus Soils.** HERMANN MINSEN (*Landw. Versuchs-Stat.*, 1905, 62, 445—476).—It is shown that neither free humic acid nor other acids (organic and mineral) in dilute solutions have a retarding effect on the rate of diffusion of water or of solutions of salts. The "physiological



dryness" of peat soils cannot, therefore, be due to free humic acid. The far-reaching conclusions which have been drawn respecting the action of free humic acid on the growth of plants do not, therefore, hold good.

N. H. J. M.

**Insoluble Alkaline Compounds formed by Humic Substances and their Rôle in Vegetable Physiology and Agriculture.** MARCELLIN BERTHELOT (*Compt. rend.*, 1905, 141, 433—445).—Potassium and calcium displace each other both in soluble and insoluble compounds, according to their proportions and the relative strengths of the mineral, organic, and humic acids.

The potassium of soluble compounds may be rendered insoluble by humic substances and thus stored for a time. It is again rendered available by double decomposition and by the spontaneous oxidation of the organic matter, the potassium then being converted into carbonate. Analogous changes occur at the expense of the calcium present in the soil as carbonate, silicate, sulphate, and phosphate, &c., or as humates.

Potassium and calcium are not directly appropriated by humic acid when in combination with strong acids. The displacement may, however, occur by the intervention of ammonia, by means of which the stronger acids are eliminated; coincidentally, amino-humic acids are formed which are capable of rendering potassium insoluble.

N. H. J. M.

**Absorptive Power of Soils for Bone and Mineral Superphosphates.** CARLO MONTANARI (*Chem. Zeit.*, 1905, 29, 988—989).—A preliminary communication. The popular idea as to the greater activity of bone superphosphate is not supported by facts. It now, however, appears that the phosphoric acid from mineral superphosphates is not quite so rapidly absorbed by the soils, although on the other hand the portion absorbed is more readily taken up by the roots.

L. DE K.

**Asparagine Substances [Amino-acids in Molasses].** PROBERTI (*Chem. Centr.*, 1905, ii, 773; from *Bull. Assoc. Chim. Sucr. Dist.*, 22, 1163—1186).—Molasses obtained in 1903 contained *N* 1.388, and *N* as amino-acids 0.969 per cent. In 1904, the amounts were 1.946 and 1.369. The high amounts of nitrogen in 1904 were coincident with a low amount of alkali. This is attributed to the roots having suffered from drought followed by heavy rainfall, conditions unfavourable to assimilation being favourable to the production of amino-acids.

N. H. J. M.

**Action of Sodium Chloride on Crops.** FERDINAND WOHLTMANN (*Bied. Centr.*, 1905, 34, 656—658; from *Landw. Zeit. Rheinprov.*, 1904, Nos. 46 and 47).—Sodium chloride did not benefit cereal crops and injured potatoes both as regards yield and quality. It was very beneficial in the case of sugar beet and mangolds.

N. H. J. M.

**Lime Manuring.** OSKAR LOEW (*Chem. Centr.*, 1905, ii, 412; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 8, 583—602).—Application of lime is desirable when the soil contains twice as much or more magnesium as calcium. Magnesia should be applied when there is a considerable excess of calcium present, even if the actual amount of magnesium in the soil is sufficient for a crop. When there is a deficiency both of calcium and magnesium, dolomite may be used with advantage.

N. H. J. M.

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## Analytical Chemistry.

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**Colorimetric Methods; a Simple Colorimeter for General Use.** OSWALD SCHREINER (*J. Amer. Chem. Soc.*, 1905, 27, 1192—1203).—An improved colorimetric apparatus, for details of which the original article and illustration must be consulted.

L. DE K.

**New Gas-absorption Apparatus.** ROMUALD NOWICKI (*Chem. Centr.*, 1905, ii, 919; from *Österr. Zeit. Berg. Hütt.*, 53, 337—338. Compare Abstr., 1904, ii, 555).—Improved Orsat apparatus in which the gaseous mixture passes through a capillary-tube into the absorbing liquid. For further particulars the original article and illustrations should be consulted.

L. DE K.

**Action of Concentrated Hydrochloric Acid on Potassium Chlorate in the Presence of Potassium Iodide or Bromide; Estimation of Chlorates.** HUGO DITZ (*Zeit. angew. Chem.*, 1905, 18, 1516—1520).—A criticism of Kolb and Davidson's paper (this vol., ii, 59).

L. DE K.

**Inner Crucible Method for Estimating Sulphur and Halogens in Organic Substances.** SAMUEL S. SADTLER (*J. Amer. Chem. Soc.*, 1905, 27, 1188—1192).—The outer crucible is made with straight sides like an inverted truncated cone with a tightly fitting lid. In the bottom is a cylindrically-shaped indentation so as to extend the highly heated zone into the inner crucible. The latter is made with sides very nearly parallel to the outer crucible when inverted within it. Small rings of platinum are soldered to the wide closed end so as to keep it centred with respect to the outer one. The wall at the open end is made as thin as possible so as to minimise the tendency to conduct heat. The edge fits about midway between the walls of the central indentation and the outer crucible.

A quantity of substance, solid or liquid, representing about 0.01 gram of sulphur or 0.05 gram of phosphorus or halogen is weighed in the inner crucible. The crucible is then filled nearly to the top with a mixture of equal parts of dry sodium carbonate and magnesium oxide. Plain magnesia is then put in level with the top so as to keep the soda away from the platinum. Ignited asbestos is put round the

raised portion of the bottom of the outer crucible to keep the two crucibles from being in actual contact. It is then lowered over the inner crucible and both crucibles inverted. A layer of the magnesia-soda mixture about one-fourth inch deep is put between the crucibles. The outer crucible is put through a hole in a piece of thin asbestos board so that the sides shall not be exposed to the direct action of the flame.

A very small pointed flame of a Bunsen burner is now applied to the indentation on the bottom, and after a few minutes the heat is increased, and finally the crucible is placed in a piece of asbestos having a larger hole, so that half of the crucible may get red hot. After ten minutes, the flame is withdrawn.

The sulphates, phosphates, chlorides, &c., formed are estimated by the usual processes.

L. DE K.

### Gravimetric Estimation of Sulphur in Iron and Steel.

CHARLES R. McCABE (*J. Amer. Chem. Soc.*, 1905, 27, 1203—1204).—To prevent the escape of unoxidised sulphur during the period of the violent action of the nitric acid, 5 grams of drillings are placed in a litre flask fitted with a doubly perforated cork which has been slightly charred on its inner end. In one perforation is fitted a funnel tube with a stopcock; in the other is fitted a piece of quarter-inch glass tubing which extends about 18 inches above the flask and is drawn to a point at the end projecting out of the flask. The stopcock being closed, 50 c.c. of strong nitric acid are introduced into the funnel tube. The acid is now run into the flask at the rate of about two drops per second. When all the acid has passed into the flask, the stopcock is closed and the flask heated gently until complete solution has taken place.

The contents are evaporated in a porcelain dish with addition of hydrochloric acid, and the sulphuric acid is then estimated by means of barium chloride as usual.

L. DE K.

**Estimation of Sulphur in Pyrites.** MAX DENNSTEDT and F. HASSLER (*Zeit. angew. Chem.*, 1905, 18, 1562—1564).—The sample is heated in a current of oxygen in a Dennstedt combustion tube (*Abstr.*, 1903, ii, 103), and the products of combustion are absorbed in four small boats filled with dry sodium carbonate and heated at about 300°. The sulphate formed is then estimated as usual. The iron oxide left in the boat is apt to retain a not inconsiderable amount of sulphur trioxide, which must then be estimated by Lunge's method (precipitation with barium chloride after removing the iron with ammonia).

Instead of sodium carbonate, lead dioxide may be used as an absorbent. After treating it with a 5 per cent. solution of sodium hydroxide, the sulphuric acid dissolved in the alkaline liquid is estimated as usual.

L. DE K.

### Estimation of Sulphur in Liquid Fuel and in Petroleum.

ALBERTO GOETZL (*Zeit. angew. Chem.*, 1905, 18, 1528—1531).—Two to three grams of the liquid fuel are placed in a spacious platinum crucible, and 4 c.c. of fuming nitric acid are added. As the reaction is



rather violent, the crucible should be covered with a watch-glass. When no further action is noticed, the crucible is heated on a water-bath, and when finally all action has ceased the watch-glass is removed and the excess of acid is evaporated. The mass is then mixed with 6 to 8 grams of a mixture of ten parts of dry sodium carbonate and two parts of nitre, and after sprinkling more of this mixture on the surface, the whole is gradually heated to fusion. The mass now contains the sulphur as sulphuric acid, which is estimated as usual.

When testing petroleum, about 10 grams should be taken for analysis.

L. DE K.

**Estimation of Sulphur in Coal.** OTTO BRUNCK (*Zeit. angew. Chem.*, 1905, 18, 1560—1562).—One gram of the finely powdered sample is mixed intimately with 2 grams of a mixture of two parts of cobaltic oxide and one part of dry sodium carbonate. The cobalt oxide must be prepared by gently igniting cobalt nitrate. The mixture is placed in a boat and then heated in a current of oxygen until the carbon has burnt off. If desired, the products of combustion may be passed through a hydrochloric acid bromine solution and a solution of sodium hypobromite to retain traces of volatilised sulphur compounds.

The residue is then extracted with water and, after adding a few c.c. of hydrogen peroxide to fully oxidise the sulphur, the filtrate is acidified with hydrochloric acid and treated with barium chloride as usual.

L. DE K.

**Estimation of Nitric Acid in the Presence of Organic Matter.** BALTHASAR PFYL (*Zeit. Nahr.-Genussm.*, 1905, 10, 101—104).—The solution containing the nitric acid (nitrates) is boiled in a small flask until all air has been expelled and the volume of the solution reduced to about 5 c.c. During this time, the delivery tube of the flask is placed below the surface of water. By means of a clamp, the water is prevented from entering the flask when the flame is removed. After the contents of the flask have cooled somewhat, 20 c.c. of a solution containing 30 grams of ferrous chloride in 50 c.c. of dilute hydrochloric acid (2:3) are allowed to enter and the closed flask is heated in a water-bath for 45 minutes. Ten c.c. of boiled dilute sulphuric acid (1:4) are then introduced, and the end of the delivery-tube is inserted under a bell-jar filled and surrounded with a 15 per cent. sodium hydroxide solution, which has been previously boiled. On heating the contents of the flask, the nitric oxide is evolved and collected under the bell-jar. From the top of the latter, an outside tube leads downwards with its end dipping under the neck of a flask filled with boiled sulphuric acid (1:4) and inverted in a vessel also containing sulphuric acid and a measured volume of  $N/10$  potassium permanganate solution. The gas is driven out of the bell-jar into the inverted flask (where it is absorbed by the permanganate) by increasing the volume of the sodium hydroxide solution surrounding the bell-jar. After completing the absorption by cautiously shaking the flask, the excess of permanganate is titrated back with  $N/10$  ferrous chloride solution.  $N/10$  Permanganate corresponds with  $1/30$   $KNO_3$  or  $1/60$   $N_2O_5$ .

W. P. S.

**Detection of Nitrates by Diphenylamine.** CARL G. HINRICHS (*Bull. Soc. chim.*, 1905, 33, 1002—1005).—For use as a reagent, diphenylamine is dissolved in glacial acetic acid. This solution produces a blue coloration when added to such oxidising substances as nitrites, peroxides of hydrogen, sodium, barium, manganese or lead, chromates, dichromates, molybdates, vanadates, permanganates, chlorates, perchlorates, ferricyanides, or iodates in concentrated sulphuric, phosphoric, or hydrochloric acid at the ordinary temperature, whereas diphenylamine gives a blue coloration with nitrates in concentrated sulphuric or phosphoric acid at the ordinary temperature, but in concentrated hydrochloric acid only on warming to  $50^{\circ}$ , or with traces of nitrates on boiling.

Similarly, brucine or ferrous sulphate reacts with nitrates in concentrated hydrochloric acid only on heating. Brucine gives no reaction with nitrites, but with vanadates a yellow colour is formed, which becomes red on addition of concentrated hydrochloric acid. Ferricyanides give similar reactions. G. Y.

**Estimation of Phosphorus in Phosphorised Oil.** HENRIK ENELL (*Chem. Centr.*, 1905, ii, 570—571; from *Pharm. Zeit.*, 50, 601—603).—One gram of the sample is dissolved in a mixture of 10 c.c. of alcohol and 20 c.c. of ether, a drop of phenolphthalein solution is added, and then 12 c.c. of  $N/10$  iodine solution. After shaking for a few minutes, the excess of iodine is carefully removed by means of  $N/10$  thiosulphate and the acid formed is titrated with  $N/10$  sodium hydroxide. Any acid already present in the sample is estimated by dissolving one gram of the oil in 10 c.c. of alcohol and 20 c.c. of ether. Twenty c.c. of water and a drop of phenolphthalein are added, and the whole is well shaken and titrated with sodium hydroxide.

The difference between the two titrations represents the phosphorus. 16.12 c.c. of  $N/10$  alkali equal 0.01 gram of phosphorus. L. DE K.

**Estimation of Phosphorus in Phosphorised Oil.** ERWIN RUPP (*Chem. Centr.*, 1905, ii, 706; from *Pharm. Zeit.*, 50, 621—622).—A criticism of Enell's process (see preceding abstract). The method in its present form only gives approximate results. L. DE K.

**Bettendorff's Test for Arsenic.** R. LOBELLO (*Chem. Centr.*, 1905, ii, 571; from *Boll. Chim. Farm.*, 44, 445—446).—The reagent is best prepared by adding one kilo. of hydrochloric acid of sp. gr. 1.19 to one kilo. of pure crystallised stannous chloride. After some time, the whole is diluted to two litres with acid of the same strength. On adding an equal volume of this solution to hydrochloric acid, the presence of even 0.001 per cent. of arsenious acid may be detected. Sulphuric acid may also be tested for arsenic by means of the tin solution. A comparative test with pure acids is advisable.

L. DE K.

**Estimation of Arsenic in Toxicology.** CARL MAI (*Zeit. Nahr. Genussm.*, 1905, 10, 290—292).—The finely-divided substance, such as the stomach, liver, intestines, muscular tissue, &c., is heated on the

water-bath to remove any alcohol if the latter has been used for preserving the substance, and is then treated with its own weight of fuming nitric acid containing 5 per cent. of sulphuric acid, the heating being continued until the whole mass becomes fluid. All the acid is now driven off by heating over a sand-bath and finally over a free flame. The resulting hard carbonaceous residue is powdered and distilled with from 5—6 times its weight of hydrochloric acid of sp. gr. 1.19. No reducing agent need be added and the whole of the arsenic will be found in the distillate when about one-third of the acid has distilled over. The distillate is evaporated after the addition of fuming nitric acid, and when almost dry a little sulphuric acid is added. The arsenic may then be estimated in the apparatus described previously by the author (*Abstr.*, 1905, ii, 284). W. P. S.

**Separation of Arsenic from Vanadium and Molybdenum.** CARL FRIEDHEIM, O. DECKER, and E. DIEM (*Zeit. anal. Chem.*, 1905, 44, 665—686).—Although trustworthy results may be obtained by several methods which are described, the following is to be preferred on account of its simplicity. About one gram of the arseno-vanadomolybdate is placed in a small flask together with 1.5 grams of potassium iodide and 70 c.c. of hydrochloric acid of sp. gr. 1.19. The mixture is distilled and the distillate evaporated with the constant addition of chlorine water, and the arsenic weighed either as the pentoxide or as magnesium pyroarsenate. The molybdenum and vanadium remaining in the flask may be separated by means of hydrogen sulphide. The precipitated molybdenum trisulphide is collected on a filter and weighed as the trioxide, whilst the vanadium in the filtrate is titrated with permanganate as usual. W. P. S.

**The Turmeric Reaction for Boric Acid.** ADOLF GOSKE (*Zeit. Nahr. Genussm.*, 1905, 10, 242—243).—It is stated that by dipping one end of a strip of turmeric paper in a solution containing boric acid and allowing the solution to ascend by capillary attraction, the test is rendered more sensitive than in the usual manner of testing. Even the smallest trace, such as 0.0001 per cent., of boric acid will give a brownish-red zone towards the upper part of the strip. W. P. S.

**Detection of Boric Acid.** OTTO MEZGER (*Zeit. Nahr. Genussm.*, 1905, 10, 243—245).—The following manner of carrying out the flame test is described. About 20 grams of the substance to be tested for boric acid are moistened with sodium carbonate solution, dried, and ignited. The ash is then treated with 20 c.c. of methyl alcohol and 2 c.c. of concentrated sulphuric acid and the mixture heated in a flask connected with a reflux apparatus. The heating is continued for fifteen minutes and the temperature not allowed to rise above 70°. After cooling, a stream of hydrogen is passed through the liquid and ignited as it leaves the flask. Very small quantities of boric acid may be detected in this way. The entire absence of water is of great importance as regards the sensitiveness of the test (compare *Abstr.*, 1905, ii, 480). W. P. S.



[Volumetric] Estimation of Boric Acid. ADOLF BEYTHIEN (*Zeit. Nahr. Genussm.*, 1905, 10, 283—286).—When using methyl-orange and phenolphthalein as indicators in the titration of boric acid, it is necessary to remove first any phosphoric acid which may be present. Each cubic centimetre of *N*/1 sodium hydroxide solution used then corresponds with 0.062 gram of boric acid. If phenolphthalein alone is employed as indicator, the removal of the phosphoric acid is unnecessary, but the quantity of boric acid neutralising 1 c.c. of *N*/1 sodium hydroxide varies with the concentration of the solution and the amount of boric acid present. The alkali solution should therefore be standardised against different amounts of boric acid. W. P. S.

Titration of Sodium Hydroxide in Presence of Sodium Carbonate. KARL NOVOTNY (*Zeit. Elektrochem.*, 1905, 11, 453—455).—When the carbonate is precipitated by exactly the required quantity of barium chloride and the sodium hydroxide then titrated by means of oxalic acid and phenolphthalein, the end-point is not sharp, the red colour continually returning until, after some days, enough acid has been added to saturate the carbonate as well as the hydroxide. This is due to the reaction between the solid barium carbonate and the dissolved sodium oxalate, and can be avoided either by using a considerable excess of barium chloride or by titrating with hydrochloric acid. T. E.

Estimation of Potassium Nitrate in Meats and Flesh Products. W. STÜBER (*Zeit. Nahr. Genussm.*, 1905, 10, 330—335).—A modification of Schlösing's method is described. The meat is boiled out with water and the extract evaporated to a small volume, after which it is transferred to a flask containing 20 c.c. of saturated ferrous chloride solution and 20 c.c. of 20 per cent. hydrochloric acid. The delivery tube of the flask is connected with the side-tube of an ordinary Schiff's nitrometer filled with boiled 20 per cent. sodium hydroxide solution. The nitrate solution is introduced drop by drop through a tapped funnel to the already boiling contents of the flask. The volume of gas obtained in the nitrometer is read off after the lapse of two hours and calculated into potassium nitrate, due notice being taken of the temperature and barometric pressure. The presence of organic nitrogenous substances is without influence on the results obtained. W. P. S.

Iodometric Determination of Aluminium in Aluminium Chloride and Aluminium Sulphate. SETH E. MOODY (*Amer. J. Sci.*, 1905, [iv], 20, 181—184).—The quantity of iodine liberated in Stock's process (*Abstr.*, 1900, ii, 247 and 315) for the gravimetric estimation of aluminium is only about two-thirds of that required by the equation  $\text{Al}_2(\text{SO}_4)_3 + 5\text{KI} + \text{KIO}_3 + 3\text{H}_2\text{O} = 2\text{Al}(\text{OH})_3 + 3\text{K}_2\text{SO}_4 + 3\text{I}_2$ . If the iodine is removed by addition of sodium thiosulphate, further liberation of iodine takes place after a time, and this is accelerated by heating. The estimation of the liberated iodine can be employed as a means of determining aluminium if the iodide-iodate mixture is heated with the aluminium solution for 15—25 minutes in a Voit flask in a

current of hydrogen or steam, and the iodine liberated collected in the potassium iodide solution. The solution in the Voit flask as well as that in the receiver must be titrated. In the presence of ammonium salts, the process is not so accurate. Attempts to obtain a complete reaction by heating the mixture under pressure gave somewhat low results.

H. M. D.

**Estimation of Manganese by means of Hydrogen Peroxide.** EDUARD DONATH (*Zeit. anal. Chem.*, 1905, 44, 698—699).—The author claims that Zeller and he were the first to publish the method of separating manganese from other metals by means of hydrogen peroxide.

W. P. S.

**Estimation of Manganese in Irons and Steels by the Persulphate Method.** HANS RUBRICIUS (*Chem. Centr.*, 1905, ii, 709—710; from *Stahl. u. Eisen.*, 25, 890).—0.25 gram of steel drillings are dissolved in 25 c.c. of nitric acid of sp. gr. 1.2. The solution is boiled down to 12 c.c., 10 c.c. of *N*/10 silver nitrate are added, the whole is diluted to 300 c.c. and boiled with 10 c.c. of a 10 per cent. solution of ammonium persulphate. When cold, the manganese, which now exists as permanganate, is titrated with a solution containing 3 grams of arsenious acid and 9 grams of sodium hydrogen carbonate in 6 litres of water until a pure green colour is obtained. When testing iron drillings, 1 gram of the sample is dissolved in 60 c.c. of nitric acid of sp. gr. 1.2, boiled, and finally made up to 500 c.c., 50 c.c. (0.1 gram) are then mixed with 10 c.c. of *N*/10 silver nitrate diluted to 300 c.c. and boiled with 10 c.c. of a 5 per cent. solution of ammonium persulphate. The permanganate formed is then titrated with the above arsenical solution.

L. DE K.

**Estimation of Manganese in the Presence of Chromium.** MAX GRÖGER (*Chem. Zeit.*, 1905, 29, 987—988. Compare Abstr., 1904, ii, 392).—An application of Volhard's process of titrating manganous salts with permanganate after removal of any iron with zinc oxide. If chromium is present instead of iron, the process is conducted as follows: to the hot solution is added a sufficiency of an emulsion of zinc hydroxide (prepared by mixing 288 grams of crystallised zinc sulphate and 28 grams of pure potassium hydroxide with 500 c.c. of water) until the chromium is all precipitated. When cold, the liquid is diluted to, say, 250 c.c., and then filtered through a dry filter. Fifty c.c. are withdrawn, mixed with a solution of 20 grams of zinc sulphate in 150 c.c. of water, the whole is heated to boiling, and then titrated with permanganate. A second experiment should always be made.

L. DE K.

**Use of Hydroxylamine in the Quantitative Analysis [Separation of Metals].** CARL FRIEDHEIM and PETER HASENCLEVER (*Zeit. anal. Chem.*, 1905, 44, 593—622).—From the results of their experiments, the authors conclude that the hydroxylamine method (Abstr., 1893, ii, 500) is of no use for the separation of iron from manganese and zinc, and that it compares unfavourably with the older and more

simple methods for separating iron from magnesium and copper. A double precipitation, at least, is necessary completely to separate aluminium from manganese, zinc, magnesium, and nickel, and the estimation of the metals in the filtrate is extremely difficult. Chromium may be separated from copper by this method, but in every other case untrustworthy results are obtained. Even where the method is applicable, it offers no advantages over the older processes.

W. P. S.

**Electrolytic Analysis of Antimony.** HERBERT DRAKE LAW and F. MOLLWO PERKIN (*Trans. Faraday Soc.*, 1905, 1, 262—263).—Antimony can be estimated quantitatively if 5—7 grams of ammonium tartrate are added to 100 c.c. of the solution, and this is electrolysed with a current density of 0.2—1.0 ampere per sq. decm. and about 3 volts. The deposits from hot solutions (60—80°) adhere to the cathode very firmly. The colour of the deposit is improved by the addition of about 1 gram of tartaric acid to the solution. The antimony deposited from cold solutions is apt to be crystalline, unless very low current densities are employed and cannot be depended on.

H. M. D.

**Ultimate Analysis of Organic Substances.** HUGO HERMANN (*Zeit. anal. Chem.*, 1905, 44, 686—698).—From the analytical figures given, it is seen that good results may be obtained by absorbing the volatile constituents, such as sulphur, chlorine, iodine, &c., of organic compounds in suitable absorbent materials contained in small boats placed in a current of the combustion gas. Attention is drawn to the fact that the glass combustion tube and the substances in contact with the material being analysed may absorb sulphuric acid and halogens, and thus introduce errors into the results.

W. P. S.

**Estimation of Carbon, Hydrogen, and Nitrogen in Cyanides.** JOSEPH A. MULLER (*Bull. Soc. chim.*, 1905, [iii], 33, 951—953. Compare Abstr., 1893, ii, 43).—For the estimation by combustion of carbon, hydrogen, and nitrogen in substances such as the cyanides, which burn completely only with difficulty, the author spreads the substance along the bottom of a platinum boat, 117 mm. long, 12 mm. broad, and 6.5 mm. deep, which is afterwards filled to the top with a mixture consisting of 83 parts of potassium dichromate and 13 parts of lead chromate. Details are given as to the size and filling of the combustion tube, the time required for combustion, and the volumes of air and carbon dioxide respectively passed through the tube. Analytical results obtained with potassium ferrocyanide show that this, after being dried at 120—125°, still retains 0.2 per cent. of water.

G. Y.

**Coal Testing.** OTTO PFEIFFER (*Chem. Centr.*, 1905, ii, 922—923; from *J. Gasbel*, 48, 713—715).—Only the volatile sulphur which passes into the gas need be estimated. The author prefers Hempel's method, in which 1 gram of the sample is burnt in oxygen in a closed bottle in presence of 20 c.c. *N*/10 alkali, the excess of the latter being



then titrated with  $N/10$  sulphuric acid. It is necessary to test for and estimate traces of nitric and hydrochloric acids also formed during the combustion, and to calculate these into their corresponding quantity of sulphur, which must then be deducted. L. DE K.

**Estimation of Alcohol in Fusel Oil.** R. PETERS (*Chem. Centr.*, 1905, ii, 573; from *Pharm. Centr.-H.*, 46, 563—568).—One hundred grams of the sample are mixed with 50 c.c. of light petroleum and the whole is shaken three times in succession with 100 c.c. of water. The aqueous solutions are united, a little charcoal is added, and 150 c.c. are distilled off. The distillate is mixed with 50 c.c. of light petroleum and shaken twice in succession with 100 c.c. of calcium chloride solution of sp. gr. 1.4. A little charcoal is added to the aqueous liquid and 100 grams are distilled off. The amount of alcohol contained therein is deduced from the sp. gr. as usual. In order to see more plainly the line of demarcation between the aqueous layer and the light petroleum, a trace of magenta may be added. L. DE K.

**Estimation of Higher Alcohols in Spirits.** ERNST BECKMANN (*Zeit. Nahr. Genussm.*, 1905, 10, 143—152).—A modification of the author's original method (*Abstr.*, 1900, ii, 175) is described. Fifty c.c. of the spirit, previously diluted with water until it contains not more than 20 per cent. of alcohol by volume, are extracted with four successive quantities of 50 c.c. of carbon tetrachloride. Shaking for a few seconds each time is sufficient. The united extracts are washed twice with 20 c.c. of water and then agitated with 2 grams of potassium hydrogen sulphate and 1 gram of sodium nitrite. After removing the carbon tetrachloride, the residue is washed twice with a little carbon tetrachloride and the whole of the latter then shaken with about 20 c.c. of saturated sodium hydrogen carbonate solution to remove excess of nitrous acid. The carbon tetrachloride layer is now transferred to a separating funnel containing 75 c.c. of concentrated sulphuric acid, well shaken, and the mixture run slowly on to 150 grams of powdered ice. The resulting solution is finally titrated with permanganate solution. In order to obtain a sharp end-point in the titration, it is advisable to add about 20 per cent. of the permanganate solution in excess, and to titrate back with ferrous ammonium sulphate solution. W. P. S.

**Estimation of Glycerol in Wines.** J. LABORDE (*Ann. Chim. anal.*, 1905, 10, 340—344).—From 50 to 100 c.c. of the wine are evaporated, and the syrup obtained is treated with 100 grams of finely divided lead and an alcoholic solution of slaked lime equal in quantity to the sugar present. The paste is well mixed with from 100 to 300 c.c. of alcohol and heated to a temperature of about  $75^{\circ}$ . After cooling, the whole is poured on a filter and a definite volume of the filtrate mixed with 0.5 gram of tartaric acid and a little lead and evaporated; the residue is then treated with calcium carbonate and extracted three or four times with the usual alcohol-ether mixture. The solution may be evaporated under reduced pressure and the glycerol weighed, or it may be acidified with a few drops of

sulphuric acid and the solvent evaporated off; 15 c.c. of water and 6 c.c. of sulphuric acid are then added and the mixture heated until the glycerol is completely carbonised. The flocculent carbon is now collected on a filter, dried, and weighed. W. P. S.

**Estimation of Glycerol in Liqueur Wines.** XAVIER ROCQUES (*Ann. Chim. anal.*, 1905, 10, 306—309).—Two hundred c.c. of the wine are evaporated to a syrupy consistency and the residue mixed with a quantity of calcium oxide equal to that of the sugars present in the volume of wine taken. After the lapse of half an hour, about 200 c.c. of 97 per cent. alcohol are added with constant stirring. The mixture, after a further half hour, is poured on a filter and the filter washed with alcohol. The filtrate is then acidified with an alcoholic solution of tartaric acid and most of the alcohol is distilled off. The residue is mixed in a basin with about 5 grams of calcium oxide and 10 grams of fine sand and dried in a desiccator under reduced pressure. The dry residue is treated in a flask with 80 c.c. of ethyl acetate and 20 c.c. of alcohol for two hours, then filtered, and a portion of the filtrate evaporated under reduced pressure over sulphuric acid for three days, when the residue of glycerol is weighed. W. P. S.

**Comparative Estimations of Glycerol.** FR. SCHULTZE (*Chem. Zeit.*, 1905, 29, 976—980).—A criticism of the various methods in use for the estimation of glycerol as applied to fats, soaps, and glycerol preparations. The conclusion arrived at is that the only trustworthy method is the hydriodic acid process proposed by Zeisel and Fanto.

L. DE K.

**Nitrogenous Impurities of Glycerol and Fats.** E. SCHMITT (*Chem. Centr.*, 1905, ii, 927; from *Les Corps Gras industriels*, 32, 20—21).—9.7 kilos. of a commercially pure glycerol were distilled with 500 c.c. of aqueous sodium hydroxide until half a litre had been collected. The alkaline distillate, which had a very pungent odour, was neutralised with hydrochloric acid and evaporated to dryness, when it yielded two grams of a semi-crystalline substance almost completely soluble in alcohol, and yielding crystals from that solvent. An analysis showed these to consist of salts of amines, carbylamines, and perhaps amidised derivatives, glycines, &c. These substances are no doubt decomposition products of proteid compounds present in the fats before saponification.

L. DE K.

**Detection of Lævulose in the Human Body Fluids.** RUDOLF OFNER (*Zeit. physiol. Chem.*, 1905, 45, 359—369).—The conclusion is drawn that the Seliwanoff reaction is always the best method for the detection of lævulose. The Neuberg-Strauss osazone method is not so satisfactory.

W. D. H.

**Detection of Lævulose in the Presence of Glucosamine.** CARL NEUBERG (*Zeit. physiol. Chem.*, 1905, 45, 500. Compare Abstr., 1903, i, 74; 1905, i, 90).—The mixture of the two substances is placed on the boiling water-bath with phenylmethylhydrazine for

three to five minutes; the phenylmethylosazone of lævulose is then formed and is precipitated on cooling. In this short time, the glucosamine does not form a compound.

W. D. H.

**Quantitative Hydrolysis of Saccharose, Maltose, Lactose, and Raffinose.** BALTHASAR PFYL and BR. LINNE (*Zeit. Nahr. Genussm.*, 1905, 10, 104—110).—The authors employ a bronze pressure cylinder which is provided with a screw head carrying a manometer and valve chamber. Inside the cylinder there is a thick-walled glass tube, in which the solution of the sugar is placed. Any pressure up to 50 atmospheres can be obtained in the apparatus by connecting the valve chamber with a carbon dioxide cylinder. During the hydrolysis, the apparatus is suspended in a glycerol bath of the desired temperature. It was found to be impossible to completely hydrolyse saccharose in the presence of mineral or organic acids without destroying some of the products formed. In the absence of acids, however, saccharose is completely hydrolysed in  $2\frac{3}{4}$  hours at a temperature of  $125^{\circ}$  and carbon dioxide pressure of 20 atmospheres. Dextrin, maltose, and lactose are not acted on under these conditions. Raffinose is quantitatively converted into melibiose and lævulose when heated for three hours at this temperature and pressure.

Maltose and lactose are best hydrolysed by heating in a 2 per cent. solution of benzenesulphonic acid for  $2\frac{1}{2}$  hours at a temperature of  $110^{\circ}$ . The method may be used for the estimation of saccharose in honey, condensed milk, &c.

W. P. S.

**Estimation of Sucrose in Presence of Lævulose and Dextrose.** HENRI PELLET (*Chem. Centr.*, 1905, ii, 711—712; from *Bull. Assoc. Chim. Sucr. et Dist.*, 22, 1041—1048. Compare this vol., ii, 558).—The author has proved experimentally that the rotatory power of a solution of lævulose is increased by strong acids, but is not altered by sulphurous or acetic acid. Salts slightly increase the rotation. Prolonged heating considerably decreases the rotatory power in purely aqueous or saline solutions; addition of strong acids does not cause any alteration. It is therefore useless to acidify liquids containing sucrose before inverting according to Clerget's method. In cane-sugar molasses, the rotatory power of lævulose depends on the conditions under which the juice and the products obtained have been heated; the higher the temperature to which they have been subjected, the more is the rotatory power of the lævulose diminished. In the presence of dextrose, the action of the lævulose on polarised light may therefore be faint or strong. As the exact rotatory power of the lævulose contained in cane-sugar products which have been subjected to prolonged heating is not known, it is not possible to calculate the amount of lævulose and dextrose in a molasses, as the formula only applies to pure non-heated lævulose. This may also explain the untrustworthy action of the total reducing sugars often noticed in analyses of molasses.

L. DE K.

**Two New Aldehyde Reactions.** W. B. RAMSDEN (*Mem. Manchester Phil. Mag.*, 1905, 49, xvi, 1—3).—The first reaction may



be expressed by the equation  $\text{Na}_2\text{SO}_3 + \text{H}\cdot\text{COH} + \text{H}_2\text{O} = \text{NaHSO}_3, \text{HCOH} + \text{NaOH}$ . The test solution is made by dissolving 50 grams of sodium metabisulphite in 100 c.c. of water, adding 50 per cent. sodium hydroxide until nearly neutral, and finally decinormal alkali until phenolphthalein indicates the slightest alkalinity. If 2 c.c. of this solution and 1 c.c. of phenolphthalein are added to the neutralised solution to be examined, a pink to red colour is produced if formaldehyde is present. The delicacy of test is about four parts per million. Other aldehydes give the reaction, but not with the same dilution.

Nessler's reagent in fairly strong solutions of formaldehyde gives an immediate blackish-brown precipitate; in weaker solutions, a canary-yellow coloration is first produced; the solution then becomes slightly opalescent and darker in colour, and when kept a precipitate settles out. The reaction is quite apparent at a dilution of one part in two millions.

H. M. D.

**The Hydrogen Peroxide Method of Estimating Formaldehyde.** JOHN K. HAYWOOD and BERNARD H. SMITH (*J. Amer. Chem. Soc.*, 1905, 27, 1183—1188).—A study of the method proposed by Blank and Finkenbeiner. The following modification gives trustworthy results. Fifty c.c. of *N*-sodium hydroxide are placed in a 500 c.c. Erlenmeyer flask, and 50 c.c. of pure 3 per cent. hydrogen peroxide are added. Three c.c. of the sample are now added from a pipette, which almost reaches the liquid in the flask. A funnel is placed on the flask, which is then put on the steam-bath for five minutes. When cold, the excess of alkali is titrated with normal acid, using litmus as indicator. From the volume of the sample used and its sp. gr., the percentage by weight of formaldehyde may be calculated.

L. DE K.

**Titration of Acetaldehyde.** ALPHONSE SEYEWETZ and BARDIN (*Bull. Soc. chim.*, 1905, [iii], 33, 1000—1002. Compare *Compt. rend.*, 1905, 141, 959; Seyewetz and Gibello, *Abstr.*, 1904, ii, 521).—The solution is cooled to 4—5° and diluted until it contains not more than 7—8 per cent. of acetaldehyde. Of this solution, 10 c.c. are added to about 40 c.c. of a 10 per cent. solution of sodium sulphite containing a drop of a 0.2 per cent. phenolphthalein solution, and carefully neutralised by addition of an acid. The mixture is titrated with sulphuric acid, which is utilised according to the equation  $2\text{Na}_2\text{SO}_3 + 2\text{C}_2\text{H}_4\text{O} + \text{H}_2\text{SO}_4 = 2(\text{C}_2\text{H}_4\text{O}, \text{NaHSO}_3) + \text{Na}_2\text{SO}_4$ . The reaction is not influenced by the presence of alcohol, paraldehyde, or acetal.

This method of estimation gives accurate results with even very dilute solutions of acetaldehyde (1 : 3000 aq.), as does also the method of estimating the aldehyde by titration of the hydrochloric acid liberated on its addition to hydroxylamine hydrochloride (compare Cambier and Brochet, *Abstr.*, 1895, i, 641).

G. Y.

**The Vanillin Reaction for the Detection of Ketones.** M. KUTSCHEROFF (*Zeit. anal. Chem.*, 1905, 44, 622—625).—The most satisfactory conditions under which this test (*Abstr.*, 1905, ii, 489) should be carried out are as follows: 3 c.c. of a freshly prepared 15 per

cent. solution of vanillin in pure alcohol are added to the solution to be tested, and then 1 c.c. of concentrated sulphuric acid is introduced. After fifteen minutes, the coloration, if any, is observed. Acetone, when present in quantity greater than 0.01 per cent., gives a carmine-red coloration, whilst the higher ketones yield a blue or greenish-blue colour. On diluting the mixture with twice its volume of water, the red coloration changes to yellow, but the blue remains unchanged. Should both acetone and higher ketones be present, the colour produced on dilution will be more or less green. Aldehydes, if present, should be removed by fractional distillation before applying the test.

W. P. S.

### Electrometric Determination of the Acidity of Urine.

LADISLAUS VON ROHRER (*Pflüger's Archiv*, 1905, 109, 391—392. Compare Abstr., 1901, ii, 672).—A reply to H. Sahli (*Lehrbuch Klin. Untersuchungsmethoden*, 1905). The author has already drawn attention to the difference between the expressions hydron concentration and acidity as determined by titration with alkali. J. J. S.

Estimation of the Volatile Fatty Acids in Palm Oils and Butter. ORLA JENSEN (*Zeit. Nahr. Genussm.*, 1905, 10, 265—283).—The author has separated the volatile fatty acids found in cocoa-nut oil and butter by fractional precipitation of their silver salts, and has determined the solubilities of these acids in water. Capric [decoic] acid is practically insoluble in water at a temperature of 15°, whilst caprylic [octoic] acid and caproic [hexoic] acid dissolve to the extent of 0.079 and 0.872 per cent. respectively. Analyses of butter from various countries are given, the results showing that the percentages of butyric and caproic acids in butter vary very considerably. In mixtures containing known quantities of butter and cocoa-nut oil it is shown that the Reichert-Meissl and Polenske values are always higher than the calculated values, but that the Kirschner values (Abstr., 1905, ii, 213) of the mixtures agree well with the calculated figures. The results obtained in Kirschner's process vary in proportion to the Reichert-Meissl values and this process is of more use in detecting the presence of butter and cocoa-nut oil in margarine than for estimating cocoa-nut oil in butter.

W. P. S.

Valuation of Tannic Acid. WALTER S. WILLIAMS (*J. Soc. Chem. Ind.*, 1905, 24, 877—879).—The well-known process of titration with permanganate in the presence of sufficient indigo solution is recommended and the operation is repeated after removing the true tannin from the solution by means of gelatin.

A practical printing experiment on a small scale is recommended as being sufficiently accurate for the wants of dyers in order to form an opinion as to the mordanting power of their tannins.

Dreaper's statement that gallic acid is equally suitable from a dyer's point of view seems to be erroneous.

L. DE K.

[The Amount of Fat in] Goats' Milk. UJHELYI (*Milch.-Zeit.*, 1905, 34, 403—405).—Systematic analyses of the milk yielded by

seven goats during the year 1904 showed the average amount of fat to be 4.01 per cent. This amount is lower than that usually found in goats' milk when the animals are fully matured and in good condition, but these goats were well kept. W. P. S.

**Estimation of Fat in Milk deficient in Fat.** TH. SV. THOMSEN (*Landw. Versuchs-Stat.*, 1905, 62, 387—399).—When the proteids of milk are peptonised and the milk dried with a mixture of kaolin and barium carbonate for the estimation of fat, the same results are obtained with Gottlieb's method as with the extraction method. The results agree, moreover, with those obtained by Gottlieb's method with unpeptonised milk, but are considerably higher than the results obtained in unpeptonised milk by the extraction-method.

It is shown that the amount of insoluble residue obtained in Gottlieb's method is insignificant, and that it dissolves completely in a mixture containing less ether and more light petroleum.

N. H. J. M.

**Estimation of Fat, Lactose, and Proteids in Milk.** THEODOR LOHNSTEIN (*Chem. Centr.*, 1905, ii, 353; from *Ber. deut. pharm. Ges.*, 15, 98—107).—The estimation of fat in milk is made by means of the author's galactoliptometer (*Chem. Centr.*, 1905, i, 1334). For the estimation of the lactose, 5 c.c. of the milk are mixed in a test-tube with 0.4 c.c. of 25 per cent. hydrochloric acid, and heated for thirty minutes in a boiling brine-bath. The solution is cooled rapidly, and, after adding 1 c.c. of 15 per cent. potassium hydroxide, is diluted to 10 c.c. Without removing the curd, the whole is fermented for 2—2½ hours at 32—38° in the fermentation saccharometer, when all the dextrose disappears before the galactose begins to ferment. The result multiplied by 4.33 represents the lactose.

The proteids (*e*) are calculated from the sp. gr., the fat, and the lactose. For cow's milk, the formula is

$$e = \frac{d - dw}{0.0028} - 2.29 - 1.34z + 0.277f,$$

in which *d* = sp. gr. at 4°/4°, *dw* the sp. gr. of water at the temperature of the experiment, *z* the lactose, and *f* the fat. In the case of human milk, 1.2 is substituted in the formula for 2.29. L. DE K.

**Variations in the Non-fatty Solids of Milk Resulting from Interrupted Milking.** FRANZ LAUTERWALD (*Milchw. Zentr.*, 1905, 1, 385—400).—Results are given of analyses of various fractions of milk obtained from a number of cows, from which it is seen that the percentage of non-fatty solids decreases as the milking proceeds, whilst the amount of fat in the fractions gradually increases (compare *Abstr.*, 1902, ii, 466). When, however, the non-fatty solids are calculated on the fat-free serum, the variation in the percentage practically disappears, showing that the depression of the non-fatty solids in the later fractions of the milk is balanced by the increase of fat and, further, that the formation of fresh milk in the udder does not take place to any great extent during the milking. W. P. S.



**Analysis of Curdled Milk.** LUDWIG VON WISSELL (*Milchw. Zentr.*, 1905, 1, 401—417).—The addition of ammonia to sour or curdled milk in order to render the latter liquid again has no influence on the estimation of the fat in the milk by Gottlieb's, Gerber's, or the plaster methods if the quantity of ammonia added is allowed for. The calculated sp. gr. of the sample, however, is usually about 0.0010 too high, and the total solids are on the average 0.44 per cent. too low.

W. P. S.

**Estimation of Fat in Butter by Gottlieb's Method.** ANTON BURR (*Zeit. Nahr. Genussm.*, 1905, 10, 286—290).—From 1 to 1.3 grams of the well-mixed sample are washed through a funnel into a Röse's cylinder by means of about 10 c.c. of hot water. After cooling, 1 c.c. of ammonia is added, then 10 c.c. of alcohol, and finally 25 c.c. of ether. The alcohol and ether are poured through the funnel to wash all the adherent fat into the cylinder. The remainder of the process is carried out as in Gottlieb's method for the estimation of fat in milk (Abstr., 1905, ii, 559).

W. P. S.

**Detection of Rancidity in Butter.** PAUL SOLTSIEN (*Chem. Rev. Fett-Harz-Ind.*, 1905, 12, 177—178).—Although the smell of rancid butter is unmistakable, it is advantageous to confirm this by means of a chemical reaction. For the latter purpose, the butter is distilled in a current of steam, the distillate is neutralised and again distilled. This second distillate is then mixed with Welmans' reagent (Abstr., 1900, ii, 697) and the mixture treated with an excess of ammonia. After the lapse of about one minute, a blue coloration appears if the fat is rancid. The depth of colour obtained depends on the degree of rancidity.

W. P. S.

**Estimation of Fat.** LEO LIEBERMANN (*Pflüger's Archiv*, 1905, 108, 481—488).—The author replies to various criticisms of his method of fat estimation (Abstr., 1898, ii, 655). He states that concentrated potassium hydroxide does not act on fat-free peptones, albumins, or cellulose to produce decomposition products soluble in ether. He further states that although his method gives higher results than the extraction method under the usual conditions, yet the latter agrees with the former if the extraction with alcohol is prolonged for about a day, and similarly with ether. A complete extraction of the fat is effected with difficulty.

J. J. S.

**Iodine Numbers of Oils.** RAFFAELLO PAJETTA (*Gazzetta*, 1905, 35, ii, 53—57).—In order to ascertain the effect of age on the value of the Hübl's iodine number of an oil, the author has determined, for fresh and old samples of cod-liver and olive oils, the iodine numbers for: (1) the oils themselves; (2) the oils after being rendered neutral by washing with alcohol, and (3) the alcoholic washings. The mean values obtained are given in the following table:

	Original oil.	Neutral oil.	Alcoholic washings.	Solubility of original oil in 1000 c.c. of alcohol.
Cod liver oil, fresh .....	137.6	136.3	143.6	37.2 grams
„ „ of 1901.....	146.0	142.7	155.3	26.9 „
Olive oil, of 1903 .....	82.78	81.19	84.84	25.15 „
„ very old and discoloured,	68.89	67.99	69.05	70.9 „

The numbers obtained for the neutral oil indicate the quantities of iodine absorbed by the fixed combined acids (which are almost insoluble in alcohol), that is, by the mixture of glycerides forming the basis of the oil. Those given by the alcoholic washings represent the iodine absorbed by the free acids and by the aldehydic and ketonic products developed as the oil becomes rancid.

It will be seen from the above table that the iodine number of the oil is roughly the mean of those of the neutral oil and the alcoholic extract. With increase of rancidity, the difference between these two outside values diminishes considerably, the three numbers tending, in the case of olive oil, to become equal. For different samples of any one oil, the iodine numbers of the neutral oils are more nearly equal than those of the original samples.

T. H. P.

**Test for the Purity of Cocoa-nut Oil.** ERNEST MILLIAU (*Ann. Chim. anal.*, 1905, 10, 298—302).—Four c.c. of the filtered oil are mixed in a test-tube with 2 c.c. of a saturated solution of phloroglucinol in ether and 2 c.c. of a saturated solution of resorcinol in benzene. After cooling the mixture to a temperature of 10°, 4 c.c. of nitric acid of sp. gr. 1.38 are added and the whole shaken for five seconds. Pure cocoa-nut oil remains quite unchanged, but the presence of any seed oil, such as cotton, sesamé, arachis, rape, &c., causes a distinct currant-red coloration to appear. As little as 5 per cent. of seed oil may thus be detected. Colorations which appear subsequently are to be disregarded.

W. P. S.

**Copal Oils.** LEO SCHMOELLING (*Chem. Zeit.*, 1905, 29, 955—956).—A series of experiments made to distinguish the Kauri oil from the Manilla variety. The following table, which relates to the crude oils, is of interest:

	Kauri oil.	Manilla oil.
Acid number .....	3.0	28.3
Cold saponification number .....	4.9	45.7
Ester number .....	1.9	17.4
(Waller's) Iodine number .....	288.9	230.4

The iodine numbers are, however, much increased on distillation in steam. For further particulars, the original paper should be consulted.

L. DE K.

**Sesamé Oil.** H. SPRINKMEYER and H. WAGNER (*Zeit. Nahr. Genussm.*, 1905, 10, 347—353).—Results of analyses of samples of Indian, Levantine, and African sesamé oils show that there is little difference between the cold and hot pressed oils. The African oil

yielded constants which differed considerably from those given by the other two varieties. For instance, the iodine value was 114, the refraction at 40°, 60.6, and the polarisation +1.42°. The following percentages of oil were yielded by the seeds: Indian, 49.76; Levantine, 50.14; African, 54.14.

For detecting small quantities of sesamé oil in butter and margarine, the author recommends extracting the substances which give the coloration with Baudouin's reagent by means of glacial acetic acid. The residue obtained on evaporating the acid extract is treated with a little barium hydroxide and again evaporated. Artificial colouring matters in the butter remain insoluble with the barium soaps when the residue is extracted with light petroleum, but the substances giving Baudouin's reaction are dissolved. The petroleum extract is finally evaporated and the residue tested as usual. W. P. S.

**Veronal.** EMIL FISCHER and J. VON MERING (*Chem. Centr.*, 1905, ii, 640—641; from *Die Therapie der Gegenwart.*, 1904, 45. Compare Abstr., 1903, i, 552).—Veronal (diethylmalonylcarbamide) is determined in urine in the following manner. The urine is reduced by distillation under diminished pressure to about one-fifteenth its original volume and extracted with ether. The residue from the ethereal solution is boiled with animal charcoal for half an hour, filtered, and cooled to 0°, when the veronal separates in colourless needles melting at 191° (corr.).

After the consumption of 4 grams of veronal in two days, 2.49 grams (62 per cent.) was recovered in the urine of five days. The elimination was, however, not complete in that time and the method is not absolutely quantitative. N. H. J. M.

**Estimation of Uric Acid and of Purine Bases in Human Urine.** MARTIN KRÜGER and JULIUS SCHMID (*Zeit. physiol. Chem.*, 1905, 45, 1—13. Compare Krüger and Wulff, Abstr., 1895, ii, 94; Krüger, *ibid.*, 1896, ii, 281; Salkowski, *ibid.*, 1898, ii, 269; Huppert, *ibid.*, 1897, ii, 293).—The Krüger-Wulff method of precipitation with copper sulphate and sodium hydrogen sulphite has been employed for uric acid and the following pure purine bases which occur in urine: xanthine, 1-methyl- and 7-methyl- and 1:7-dimethyl-xanthines; guanine, 7-methylguanine, adenine, and hypoxanthine. The results indicate that all these compounds are completely precipitated by the original Krüger-Wulff method, or more quickly by boiling for three minutes, and that the presence of sodium chloride or sodium chloride and acetate does not affect the completeness of the precipitation.

Estimations of paraxanthine by the ammoniacal silver method give low results, as the silver compound is appreciably soluble in ammonia.

In the estimation of uric acid, the copper precipitate as obtained above is decomposed with sodium sulphide, acidified with hydrochloric acid, evaporated, and kept for several hours. A Kjeldahl determination is made of the uric acid deposited.

Krüger and Schmidt's method (Abstr., 1900, ii, 31) for the estimation of purine bases in presence of uric acid gives good results. Acids,



very dilute alkalis, and manganese dioxide do not appreciably affect the bases.

J. J. S.

**Meconic Acid in the U.S.P. Opium Assay and Certain Meconates.** EDWARD MALLINCKRODT, jun., and EDWARD A. DUNLAP (*J. Amer. Chem. Soc.*, 1905, 27, 946—964).—When assaying opium by the U.S.P. (1890) process, a yellow, scaly coating is observed on the bottom of the flasks which evidently is not morphine. The authors find it to be a double salt of meconic acid with calcium and ammonium,  $\text{CaNH}_4\text{C}_7\text{HO}_7 \cdot 2(3)\text{H}_2\text{O}$ , and its importance in the assay process lies in the fact that, when the morphine is finally found by titration, this compound consumes nearly a quarter as much acid as the morphine itself, and so more or less vitiates the results.

Contrary to previous statements, it is found that both di- and tri-barium meconates are practically insoluble in barium hydroxide solutions. An attempt to prepare the mono-meconate failed, as the di-meconate was deposited, leaving free meconic acid in the mother liquor.

L. DE K.

**Alkaloid Reactions (Amorphous Aconitine).** C. REICHARD (*Chem. Centr.*, 1905, ii, 357—358; from *Pharm. Centr.-H.*, 46, 479—486. Compare this vol., ii, 563).—In applying the phosphoric acid test, metaphosphoric acid may be substituted for the ortho-acid. Aconitine added to a concentrated acid solution of antimony trichloride gives a dark or black coloration. If a clear, minute crystal of potassium ferrocyanide is added to a drop of sulphuric acid in which has been dissolved aconitine and a little sodium ortho-arsenate, it turns blue after a few minutes. If no arsenate has been added, a blue colour is also noticed, but it then soon fades. Concentrated sulphuric acid gradually dissolves aconitine to a clear, bright yellow solution, which on warming becomes a dark violet-brown. A mixture of aconitine and ammonium molybdate becomes blue when moistened with sulphuric acid; potassium dichromate similarly gives a fine dark green coloration. If now a few particles of ammonium persulphate are added and a gentle heat is applied, the blue colour changes to a bright yellow and the green to a blue or bluish-green. Mercuric chloride has no action, but mercurous nitrate yields at once a black precipitate with aconitine. The alkaloid dissolves in concentrated nitric acid to an almost colourless solution. A mixture of aconitine, ammonium persulphate, and sulphuric acid, when gently heated, first turns a deep brownish-black, but after a few minutes becomes quite colourless and emits an odour of ozone. Copper sulphate and copper oxychloride are not reduced by aconitine, and iodine is not liberated from potassium iodate in presence of sulphuric acid. Aconitine has no action on ferric chloride, but on evaporating the mixture and moistening the residue with sulphuric acid, a dark brown solution is obtained.

L. DE K.

**Estimation of Arginine with Permanganate.** GUSTAV ORGLMEISTER (*Beitr. chem. Physiol. Path.*, 1905, 7, 21—30. Compare Pommerrenig, *Abstr.*, 1902, ii, 274; Kutscher and Zickgraf, 1903, i, 666; Zickgraf, 1904, i, 462).—Pommerrenig's negative results

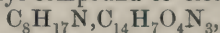
were largely due to the use of cold potassium permanganate instead of a solution of the hot calcium salt, and in using picric acid as a precipitating agent for guanidine. To estimate the arginine groups in albumin this is first hydrolysed with sulphuric acid, then oxidised with calcium permanganate by the Kutscher-Zickgraf method, and the guanidine thus obtained estimated either by weighing the guanidine picrate obtained by the addition of sodium picrate solution, or by estimating the nitrogen in it.

The percentages of arginine have been determined in a number of proteids by this method. J. J. S.

**Estimation of Alkaloids in Coca Leaves.** ANNE W. K. DE JONG (*Rec. trav. chim.*, 1905, [ii], 24, 307—308).—A modification of Keller's method for the estimation of the alkaloids in coca leaves.

M. A. W.

**Reactions for distinguishing between Nicotine and Cicutine.** R. TORRESE (*Chem. Centr.*, 1905, ii, 416; from *Giorn. R. Accad. Med. Torino*, 1905, 10).—The method of distinguishing between these two substances is based on the difference in crystalline form of their compounds with 4-piperonyl-3:5-dicyanoglutaconimide and 4-*isobutyl*-, 4-phenyl-, and 4-hexyl-3:5-dicyanohydroxypyridine respectively. This distinction is most characteristic in the case of the piperonyl compounds. The piperonyl compound of nicotine is obtained as a gelatinous precipitate which, after 20—24 hours, becomes crystalline; after recrystallising from water, it forms long, thin, transparent prisms. The corresponding piperonyl compound of cicutine,



forms short, flat prisms, which turn red at 247° and melt at 252°; they are soluble in boiling water, slightly soluble in cold water and hot alcohol, but insoluble in boiling ether. The *isobutyl* compound gives no precipitate with cicutine hydrochloride, whereas with nicotine it forms a compound of the formula  $2\text{C}_{11}\text{H}_{11}\text{O}_2\text{N}_3, \text{C}_{10}\text{H}_{14}\text{N}_2$ , forming star-shaped aggregates of long, transparent crystals which darken at 180—200° and char at 270°. The hexyl compound gives with nicotine stellar aggregates of prismatic crystals, whilst with cicutine it forms, after 10—12 hours, small plates. The phenyl compound gives fan-shaped aggregates of long prisms with nicotine and thick plates with cicutine. It is possible by means of these differences in crystalline form to identify both alkaloids in a Stas-Otto extract, provided the solution is free from salts of the alkali metals or metals of the alkaline earths. Aniline and sparteine also give precipitates with the piperonyl reagent. The paper contains tables showing the limit of dilution at which nicotine and cicutine are precipitated by the four reagents as well as by a number of the ordinary alkaloidal reagents. P. H.

**Estimation of Pyramidone.** A. ASTRUC and G. PÉGURIER (*Ann. Chim. anal.*, 1905, 10, 302—303).—An aqueous solution of the pyramidone is treated with an excess of picric acid solution of known strength. After shaking for a few minutes, the precipitate is collected

on a filter, and the excess of picric acid titrated in the filtrate with *N*/10 sodium hydroxide solution, using phenolphthalein as indicator. One molecule (231) of pyramidone precipitates one molecule of picric acid (229).  
W. P. S.

**Separation of Strychnine and Brucine.** D. LLOYD HOWARD (*Analyst*, 1905, 30, 261—263).—The author has investigated Keller's method for the separation of strychnine from brucine (*Abstr.*, 1903, ii, 342) and finds that at a sufficiently low temperature brucine can be completely destroyed in the presence of strychnine without injury to the latter. The temperature at which the treatment with nitric acid is carried out should be as near 0° as possible. The defects of Keller's method are shown to be simply those attendant on the use of a mixture of chloroform and ether as a solvent. Gordin's statement (*loc. cit.*) that the above method gives results about 4 per cent. too low, is not borne out by the author's experiments.

W. P. S.

**Colorimetric Estimation of Thiophen.** CARL SCHWALBE (*Chem. Zeit.*, 1905, 29, 895—896. Compare *Abstr.*, 1904, i, 337).—The author estimates thiophen in crude benzenes by adding 1 c.c. of the sample to a mixture of 25 c.c. of sulphuric acid and 25 c.c. of isatin-sulphuric acid (0.5 gram of isatin in 1000 grams of pure sulphuric acid). After thorough shaking, the green colour of the mixture is compared with that obtained in another experiment with a pure benzene to which a definite amount of thiophen has been added. The process is no longer applicable when the percentage of thiophen falls below 0.05.  
L. DE K.

**Evaluation of Aloes.** LEOPOLD VAN ITALLIE (*Pharm. Weekblad*, 1905, 42, 553—560).—The author states that Curaçoa aloes are from a pharmaceutical point of view not in the least inferior to the Cape variety, although they give a reaction for isobarbaloin. They are rich in aloin, but rather poor in substances which on treatment with nitric acid yield chrysamic acid. The reaction with nitric acid, however, gives rise to several by-products and is not a quantitative one.

After a futile attempt to estimate the amount of aloin by taking advantage of the green fluorescence which occurs on treating aqueous aloes solution with borax, the author endeavoured to apply the reaction with bromine both volumetrically and gravimetrically, but although very satisfactory results were obtained with pure aloin the process failed with aloes. A method based on the acetylation of aloin failed altogether with aloes, as the end reaction in the final titration could not be observed.

The following process for the estimation of the non-resinous matters, which is a slight modification of the method proposed by Tschirch and Hoffbauer, is recommended. Five grams of the powdered sample are heated in a 50 c.c. flask with 5 c.c. of methyl alcohol until a homogeneous liquid is obtained. When cooled to 60°, 30 c.c. of chloroform are gradually added with vigorous shaking for five minutes. After some time the chloroform may be poured off quite clear. The time may be shortened by placing the flask in cold water. After expelling the chloroform from the residue, this is again treated



with 5 c.c. of methyl alcohol and 30 c.c. of chloroform, and this operation is repeated three times. The undissolved resin should then no longer be sticky but form a powder. The mixed chloroform extracts are then freed from chloroform by distillation, and the residue is finally dried at 100° and weighed.

Two samples of Cape aloes yielded respectively 82 and 56.2 per cent. of extract; three samples of Curaçoa aloes gave respectively 86.4—88.6 and 78.3, and a sample of Aruba aloes gave 61.04 per cent. The figures given are the mean of two determinations in each case.

L. DE K.

**Influence of Bran on the Estimation of Gluten and on the Suitability of Flour for Bread-making.** LÉON LINDET and LOUIS AMMANN (*Compt. rend.*, 1905, 141, 56—58).—The quantitative separation of gluten from flour becomes the more difficult as the latter decreases in quality. In the case of flours known to the trade as “thirds” and “fourths,” it is practically impossible to obtain a coherent mass of gluten. This is due to (1) the abnormal acidity of inferior flour; (2) the increased proportion of glutenin to gluten; (3) the presence of a mucilaginous substance; and (4) the particles of cellular tissue which interfere with the adhesive properties of the gluten. It has been noted that gluten obtained from inferior flours contains less nitrogen than that yielded by best wheat-flour, but this is accounted for by the fact that the cellular tissue (bran) is separated together with the gluten. On account of its feeble cohesive property, flour containing much bran “rises” unsatisfactorily when used for bread-making. W. P. S.

**Volhard's Titrimetric Method for the Estimation of Pepsin and Trypsin.** WALTER LÖHLEIN (*Beitr. chem. Physiol. Path.*, 1905, 7, 120—143).—The method of estimating pepsin is based on the fact that unaltered casein dissolved in the fermenting liquid containing hydrochloric acid is completely precipitated by sodium sulphate, and the increase in the acidity of the filtrate as determined by titration, using phenolphthalein as indicator, is a measure of the extent to which the peptic digestion has proceeded. A study of numerous experiments shows that the Schütz-Huppert time and fermentation laws hold good, the increase in acidity being proportional to the square root of the product of amount of ferment and time. These laws no longer hold when the product of ferment (in c.c.) and time (in hours) is greater than 16. The equation  $x = v^2/ft$ , gives the number of units of pepsin present (compare this vol., ii, 732).

The estimation of trypsin in pancreatin may be conducted in a similar manner. The casein solution is mixed with pancreatin to which a little alkali has been added, and the mixture kept at 40° for a given length of time. *N*-Hydrochloric acid and 20 per cent. sodium sulphate are then added, the precipitated casein removed, and the increase in acidity of the filtrate determined.

The results show that the extent of fermentation is directly proportional to the amount of ferment solution and to the time, or that the number of units of ferment may be calculated from the formula  $x = v/ft$ . It is shown that normal stomach juices contain no trypsin.

J. J. S.

## General and Physical Chemistry.

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**Development of Spectro-chemistry.** JULIUS W. BRÜHL (*Royal Institution Lecture*, May 26, 1905).—An historical survey of the work done up to the present time on specific and molecular refraction.

J. C. P.

**Refractive Index of Gaseous Fluorine.** CLIVE CUTHBERTSON and E. B. R. PRIDEAUX (*Phil. Trans.*, 1905, 205 A, 319—331).—In the earlier measurements of the refractive index, in which a current of electrolytic fluorine was passed through a hollow copper prism provided with fluorspar apertures until a steady state was reached, concordant values could not be obtained. The chief causes of this are now found to be that the air cannot be completely displaced from the measuring apparatus, and that the electrolytic fluorine prepared by Moissan's method contains oxygen and ozone. These sources of error have now been taken into account. The electrolytic fluorine, after passing through a long platinum spiral cooled to  $-78^{\circ}$  to remove hydrogen fluoride, and through a second spiral heated at  $250-300^{\circ}$  to destroy ozone, entered the Jamin refractometer tube, which was made of platinum-iridium with end-plates of fluorspar. After the measurement of the refractivity, the proportions of fluorine, oxygen, and nitrogen in the tube were determined, the fluorine being conveniently absorbed by lead. The corrected mean value of the refractive index of gaseous fluorine is 1.000195. This value makes the ratio of the refractivities of fluorine and chlorine almost exactly 1 : 4, which is the ratio that the refractivities of nitrogen, oxygen, and neon bear to phosphorus, sulphur, and argon respectively (compare *Abstr.*, 1905, ii, 129).

H. M. D.

**Refractive Indices of Sulphuric Acid at Different Concentrations.** VICTOR H. VELEY and JOHN J. MANLEY (*Proc. Roy. Soc.*, 1905, A, 76, 469—487).—The refractive indices of sulphuric acid solutions containing from rather under 1 per cent. to rather more than 99 per cent. have been determined for the four lines  $H_{\alpha}$ ,  $D$ ,  $H$ , and  $H_{\gamma}$ . The temperature-coefficients have been measured and used for reducing all observations to  $15^{\circ}$ . The maximum values of the refractive indices and of the first constant of Cauchy's formula occur at a point corresponding approximately with the composition of the hydrate,  $H_2SO_4 \cdot H_2O$ ; any indication of the existence of other hydrates is doubtful; Lorentz's expression,  $(\mu^2 - 1)/(\mu^2 + 2)d$ , is a linear function of the percentage up to 90 per cent. The refractive indices, the Cauchy constants, and the Lorentz expression all show irregularities for concentrations between 92 and 100 per cent.; these irregularities are consistent among themselves, as also with a maximum density at about 97 per cent., and a minimum point between 99 and 100 per cent.

J. C. P.

**Spectrum of Silicon; Spectrum of Fluorine.** JOSEPH LUNT (*Proc. Roy. Soc.*, 1905, *A*, 76, 118—126).—Of the lines  $\lambda$  4089.1,  $\lambda$  4096.9, and  $\lambda$  4116.4, attributed by Lockyer to silicon (see Lockyer and Baxandall, this vol., ii, 129), the author finds only the first and third really to be due to that element. He supplements what is regarded as the insufficient evidence brought forward by Lockyer and Baxandall in support of their conclusions. Two new low temperature silicon lines are recorded, namely,  $\lambda$  4191.0 and  $\lambda$  4198.5.

A list of lines ascribed to fluorine is appended. The strongest of these are  $\lambda$  4103.6,  $\lambda$  4109.3,  $\lambda$  4246.5,  $\lambda$  4299.3, and  $\lambda$  4446.8.

J. C. P.

**Enhanced Lines.** JACOB STEINHAUSEN (*Chem. Centr.*, 1905, ii, 1073; from *Zeit. wiss. Photographie, Photophysik u. Photochemie*, 3, 45—48).—Lockyer's "enhanced lines" or those lines which occur in spark spectra, but are either very much less marked or entirely absent in arc spectra, have been examined in the case of aluminium, antimony, lead, cadmium, magnesium, mercury, bismuth, tin, zinc, barium, calcium, strontium, and tellurium. An induction apparatus which was capable of giving a spark of 100 cm. was used, and both the spark and the arc spectra were photographed on the same plate by means of a concave grating of a curvature corresponding with 1 metre radius. The intensity of the lines was estimated and values ascribed to each ranging from 10 to 1. A tabular list of the enhanced lines is given in the original paper. The intensity of the lines of the spark spectra was usually greatest at the ends of the spark and least in the middle; exceptions were found, however, in the ultra-violet. The spectrum of sparks passing between electrodes of aluminium and tin showed the lines of tin at both electrodes; the lines must therefore be caused by the vapour of the metal. It is probable that the phenomenon of enhanced lines does not only depend on rise of temperature, but also on increase of dissociation.

E. W. W.

**Absorption Spectra of Vapours.** WILHELM FRIEDERICH (Chem. Centr., 1905, ii, 1073—1074; from *Zeit. wiss. Photographie, Photophysik u. Photochemie*, 3, 154—164).—The absorption spectra of iodine, tellurium dichloride, and manganese perchloride,  $\text{Mn}_2\text{Cl}_7$ , have been examined. An Auer lamp was used for illumination, and the spectra, which were of low dispersion (4 cm.), were photographed. The iodine vapour was contained in quartz vessels which could be heated to  $920^\circ$ . At low temperatures, the vapour gave a good absorption band spectrum, and on heating the absorption increased up to  $500^\circ$ , but at temperatures above this it again rapidly decreased; at the maximum temperature, the absorption bands entirely disappeared. It is concluded that the vapour which shows the band spectrum consists of diatomic molecules. The absorption bands of the spectra of tellurium dichloride and manganese perchloride were found to be arranged in groups.

The ultra-violet absorption spectrum of benzene was also examined, the source of illumination being in this case a luminous capillary filled



with hydrogen (Schumann's method), closed on one side by a quartz plate. The spectrum beyond  $\lambda$  2694 contained eight distinct groups of bands. A comparison with Hartley's results (*Trans.*, 1898, **73**, 695) showed that the whole of the bands had moved towards the red end, and the smaller the wave-length the greater had been the displacement.  
E. W. W.

**Ultra-violet Absorption Spectra of the Purines.** CHARLES DHÉRE (*Compt. rend.*, 1905, **141**, 719—721).—Using as a source of illumination the electric spark between electrodes of iron and Eder's alloy (cadmium, zinc, and lead in equal parts), the author has photographed the absorption spectra afforded by different thicknesses of solutions of some members of the purine series. The longest wave-length transmitted through (1) a thickness of 20 mm. of a solution (1 in 10,000) of hypoxanthine (6-oxypurine) is 274·8, (2) a thickness of 40 mm. of a solution (1 in 20,000) of xanthine (2:6-dioxypurine) is 287·2, and (3) a thickness of 60 mm. of a solution (1 in 40,000) of uric acid (2:6:8-trioxypurine) is 306·0. These results show that the absorption spectra of the three purines extend towards the least refrangible end of the spectrum as the proportion of oxygen in the molecule increases.  
M. A. W.

**Phosphorescent Spectra of S<sub>8</sub> and Europium.** Sir WILLIAM CROOKES (*Proc. Roy. Soc.*, 1905, **A**, **76**, 411—414).—The strong line in the phosphorescent spectrum of europia is not coincident with the old anomalous line (compare Demarçay, *Abstr.*, 1901, ii, 511), the wave-length of the europia line being  $\lambda$  6128, and that of S<sub>8</sub>  $\lambda$  6094. The S<sub>8</sub> line is developed brilliantly when a little europia is added to a mixture of yttria and samaria.  
J. C. P.

**Colours in Metal Glasses, in Metallic Films, and in Metallic Solutions.** II. J. C. MAXWELL GARNETT (*Phil. Trans.*, 1905, **A**, 205, 237—288).—In this paper, mathematical analysis is applied to the explanation and co-ordination of the colours exhibited by certain metals in different circumstances. One of the conclusions reached is that Carey Lea's silver is not allotropic, but consists of normal silver in a finely-divided state. A similar view is adopted by the author regarding other so-called allotropic forms of metals.  
J. C. P.

**Investigation of Fluorescence.** HUGO KAUFFMANN (*Chem. Zeit.*, 1905, **29**, 1032—1034).—A survey of recent researches on fluorescence.  
J. C. P.

**Fluorescence of Sodium Vapour and the Resonance Radiation of Electrons.** ROBERT W. WOOD (*Phil. Mag.*, 1905, [vi], **10**, 513—525. Compare *Abstr.*, 1903, ii, 621).—The author has succeeded in detecting the lateral emission of yellow light by non-luminous sodium vapour when illuminated by the light from a very intense sodium flame.

The same phenomenon has been observed in the region of the

channelled absorption, but in this case radiations of other wave-lengths are emitted as well as that of the exciting light. The phenomenon is termed *resonance radiation* to distinguish it, if need be, from fluorescence.

The apparatus employed consisted of a seamless steel tube, 3" diameter, 30" long, fitted with plate-glass ends. This tube could be exhausted, and inside it, at its centre, was placed a smaller steel tube in which the sodium was contained. The ends of the smaller tube were closed by steel discs provided with oval apertures through which the stimulating beam was brought to a focus in the very dense layer of sodium vapour formed in the upper part of the tube on heating. For details of the method of observing the laterally emitted light, the original must be consulted.

With white light illumination, the fluorescence spectrum is made up of a large number of hazy lines arranged in bands which lie close together in the vicinity of the *D* lines, widening as the blue region is approached. Coincident with the *D* lines is a hazy band in which two component lines coincident with  $D_1$  and  $D_2$  are recognisable. These lines only appear when the vapour is stimulated with light of the wave-length of the sodium lines, indicating that the electron system which produces these lines is independent of the systems which give rise to the channelled spectra. The region in the immediate neighbourhood of the *D* lines is nearly devoid of light, and the red fluorescence is only readily observed when the density of the vapour is considerable. When approximately monochromatic light is employed as the stimulating source, the emission spectrum consists of a number of more or less regularly spaced bright lines of different intensities. The slightest change in the wave-length of the incident light results in the disappearance of these lines and the appearance of another set. The phenomenon indicates that the sodium atom consists of a number of groups of electrons, the excitation of any one of which sets the entire group in vibration, without, however, disturbing the other groups. Radiations both above and below the exciting radiation are present in the emission spectra, showing that Stokes' law is not obeyed.

H. M. D.

**Theory of Photographic Processes. II. Chemical Dynamics of Development, including the Microscopy of the Image.** SAMUEL E. SHEPPARD and CHARLES E. K. MEES (*Proc. Roy. Soc.*, 1905, *A*, 76, 217—234. Compare this vol., ii, 294).—A microscopic study has been made of the influence of exposure and development on the size of grain and number of grains in photographic plates. The general results of the study are in agreement with the theory of development previously proposed. Each grain develops as a more or less isolated system, only uniting to form "aggregates" with other grains at high exposures, when the packing is closer. The thickness of the reaction layer is from 0.02 to 0.04 mm., a value similar to that found by Brunner for many heterogeneous reactions.

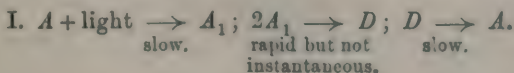
The authors have used extensively the "time of appearance" in studying development kinetics. The velocity of development for most

developers is given by the expression  $K = 1/t \cdot \log \gamma_\infty / (\gamma_\infty - \gamma)$ , and it is found that the temperature-coefficient of the velocity frequently exceeds the value to be expected from the diffusion theory. Consideration, however, of the various conditions shows that a high temperature-coefficient in development does not necessarily mean that the velocity is that of a chemical reaction. The authors believe that the action of soluble bromides furnishes a means of distinguishing between diffusion velocity and chemical velocity. Consideration of that action and of the reversibility of development makes it probable that the development process generally takes place in two phases. In the first period, the chemical velocity is low compared with that of diffusion, in the second period the contrary holds. It is the velocity of the second period which is usually measured.

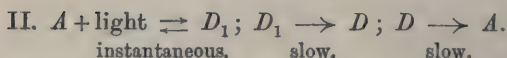
J. C. P.

**Reversible Photochemical Reactions in Homogeneous Systems. Anthracene and Dianthracene. II.** ROBERT LUTHER and FRITZ WEIGERT (*Zeit. physikal. Chem.*, 1905, 53, 385—427. Compare Abstr., 1904, ii, 463).—The earlier investigation has been extended and supplemented. The curve obtained by plotting the concentration of dianthracene at the equilibrium point against the concentration of anthracene in the solution approaches a limit without exhibiting a maximum. The extent of absorption in anthracene ( $A$ ) and dianthracene ( $D$ ) solutions has been studied, and it is found that the absorptive power of dianthracene is small compared with that of anthracene. The velocity of the photochemical reaction  $A \rightarrow D$  depends on the same factors as determine the equilibrium point. The velocity of the contrary reaction  $D \rightarrow A$  is not affected by light, and the temperature-coefficient in this case is that of an ordinary chemical reaction. A rise of temperature diminishes, *ceteris paribus*, the concentration of dianthracene at the equilibrium point, but has no appreciable effect on the velocity of the reaction  $A \rightarrow D$ .

The general formula (due to Wittwer and Nernst) for the fundamental law of photokinetics does not represent the experimental results of the authors' work. Consideration of photochemical reactions hitherto studied indicates that these are always of the first order, and this leads to the following formulation of the fundamental law of photokinetics: "The quantity of a substance sensitive to light which undergoes change in the volume  $dv$  per unit of time is proportional to the light absorbed during the same time by the substance in the volume  $dv$ ." If this is applied to the case under consideration, it may be shown, in harmony with the observed facts, that the concentration of dianthracene at the equilibrium point approaches an upper limit as the concentration of anthracene increases. Quantitative agreement, however, between calculated and observed effects could not be obtained for points short of this upper limit. To secure agreement, the authors suppose that intermediate substances with absorptive power are formed in the reaction. The suggestions made in this direction are indicated below:







$A_1$  is termed "photoanthracene," and  $D_1$  "photodianthracene." With these hypotheses, it is possible to interpret all the experimental results obtained.

J. C. P.

**Triboluminescence.** C. S. STANFORD WEBSTER (*Chem. News*, 1905, 92, 185).—Large crystals of salicylic acid placed on flannel and crushed against a glass plate or shaken violently in a bottle emit brilliant flashes visible in the dark. The natural acid is less active than the artificial, but both respond to radium to an unusual degree for organic triboluminescent compounds of the first order. A sheet of ground glass mounted in a frame with a handle is found convenient for examining hard substances for triboluminescence, rubbing them on the rough side and observing from the other.

D. A. L.

**Triboluminescence in the Acridine Series.** GILBERT T. MORGAN (*Chem. News*, 1905, 92, 219).— $\beta\beta$ -Dinaphthacridine either in the form of straw-coloured needles or of transparent, amber-coloured prisms, when crushed between ground glass plates emits a vivid, yellow luminescence until pulverisation is complete. The luminescence is also observed when the amber-coloured prisms adhering to the sides of the crystallising vessel are scraped with a spatula. Under similar treatment, triboluminescence is not manifested by the yellow hydrochloride, hydriodide, methiodide, or ethiodide of  $\beta\beta$ -dinaphthacridine, or by acridine itself.

D. A. L.

**Radioactivity of the Boric Acid Suffioni of Tuscany and the Amount of the Emanation contained therein.** RAFFAELLO NASINI, FRANCESCO ANDERLINI, and MARIO G. LEVI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 70—76).—The authors have examined the radioactivity of the gases evolved from the boric acid suffioni of Tuscany by the electroscopic method. The dispersion per hour in an Elster and Geitel electroscope with a metal bell, 33 cm. high and 19 cm. in diameter and hence 9300 c.c. in capacity, varies between 500 and 20,000 volts, the lowest value being obtained with gases from the suffioni of Travale, which contain the least amount of boric acid. The radioactivity does not depend on the pressure, temperature, depth, or content of carbon dioxide or water vapour of the gases, and that of any one suffione does not vary with time. The gases of Lardarello, which are among the most radioactive, contain about  $1.5 \times 10^{-5}$  cm. of emanation per cubic metre; after absorption of the carbon dioxide and hydrogen sulphide by potassium hydroxide, the dispersion is raised from 12,000 to 200,000 volts per hour, an increase which is exactly in proportion to the amount of the diminution in volume of the gas.

T. H. P.

**Radioactive Constituents of the Deposits of Echaillon and Salins Moutiers.** G. A. BLANC (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 322—328. Compare this vol., ii, 221).—On separating the radio-

active constituents of the deposits from these mineral springs, it is found that the precipitated sulphate increases in radioactivity only very slightly after precipitation, thus differing from other radium preparations; possibly another active element is present with the radium in the insoluble sulphate. The precipitate obtained by means of ammonia is several hundred times more active than thorium hydroxide. The fall in the activity of the emanations and in the induced activity corresponds exactly with that of the thorium salts. The radioactive phenomena observed with thorium salts are due not to an intrinsic property of the element itself, but to the presence of traces of a highly active element, analogous in its chemical characters with thorium and hence difficult to separate from it. T. H. P.

**Radioactivity of some Springs in the Southern Viennese Thermal Zone.** HEINRICH MACHE and STEFAN MEYER (*Monatsh.*, 1905, 26, 891—897. Compare this vol., ii, 498).—The authors have determined the radioactivity of the water from various springs in Fischau, Vöslau, and Baden, as also from the Theresienbad and from a spring in the Türkenstrasse in Vienna. The results are given in tabular form. The Theresienbad and Türkenstrasse springs are only slightly radioactive; the Baden springs are much more highly radioactive than the Fischau and Vöslau springs. The ratio, *emanation in water : emanation in gas*, is approximately the same, 0.22—0.28, for each spring, and corresponds with the normal equilibrium at the relatively low temperatures of these springs.

The ratio, *emanation in water : emanation in gas*, calculated from Henrich's results for the Adler spring and the Kochbrunnen in Wiesbaden (this vol., ii, 221), 0.017—0.031, shows that that author's determinations are not comparable with each other, or that in these springs the gas, and not the water, is primarily active.

The radioactivity of the emanation from the Fischau springs decays to half of its initial value in 3.82 days, and has  $\lambda(\text{sec.}) = 4.76 \times 10^5$ ; the corresponding values obtained with the emanation from the Vöslau springs are 4.02 days and  $\lambda(\text{sec.}) = 5.01 \times 10^5$ ; and from the Baden springs, 3.86 days and  $\lambda(\text{sec.}) = 4.81 \times 10^5$ . G. Y.

**Radioactive Minerals.** ROBERT J. STRUTT (*Proc. Roy. Soc.*, 1905, 4, 76, 88—101, 312. Compare Boltwood, *Abstr.*, 1904, ii, 666; 1905, ii, 295).—The amount of radium in a mineral is proportional to the uranium. The investigation of this point demonstrated the existence of uranium in some minerals (for example, monazite) not previously known to contain it. Thorium minerals invariably contain the uranium-radium combination, an observation which possibly indicates that thorium is producing uranium. Helium occurs only in very minute quantity, unless thorium is present, and hence the helium in minerals is probably produced more by thorium than by radium. Thorium minerals vary much in emanating power; some retain nearly all their emanation, others give off large quantities. J. C. P.

**A Radioactive Substance discovered in the Transvaal and Experiments connected therewith.** R. LEWIS COUSENS (*Chem. News*, 1905, 92, 203—206, 213—215).—An alluvial deposit traced to

the overflow of a volcanic vent exhibited radioactivity, and by washing and panning yielded about 0.2 per cent. of material consisting of inactive silica and radioactive zircon, rutile, magnetite, and ilmenite, with perhaps a very small quantity of other minerals. The activity was greater from the material in a closed than in an open vessel. When dissolved in hydrochloric acid and precipitated successively with ammonia, ammonium chloride, and ammonium carbonate, the radioactive substance was mainly concentrated in the ammonia-ammonium chloride precipitate. The usual experiments were made with it, when the manifestations usual with radium were observed. It is also precipitated from solution with barium sulphate. The radioactivity is therefore attributed to radium, the latter being regarded as derived from titanium.

D. A. L.

**Measurement of the Emanations contained in Liquids.** HEINRICH WILLY SCHMIDT (*Chem. Centr.*, 1905, ii, 1072; from *Physikal. Zeit.*, 6, 561—566).—The metal flask which contains the liquid to be examined is fitted with two taps, to one of which india-rubber tubing is attached and to the other an india-rubber ball. Both are connected with the vessel in which the emanation is to be measured. The electroscope is placed outside the vessel, and is connected with the substance inside the vessel by means of brass strips with amber insulation. The movement of the aluminium leaf is measured to within about 0.05 volt by means of a microscope. After thoroughly shaking the liquid in the flask for half a minute, the moist air is driven into the measuring vessel by means of the rubber ball. Formulæ for the calculation of the effect of induced activity are given in the original paper and the calculated corrections are arranged in tables. The absorption-coefficients for radium emanations have been determined, and found to be similar to those obtained by R. Hofmann.

E. W. W.

**The Ultimate Disintegration Products of the Radioactive Elements.** BERTRAM B. BOLTWOOD (*Amer. J. Sci.*, 1905, [iv], 20, 253—267).—To obtain knowledge regarding the ultimate disintegration products of radioactive elements, careful study of the composition of radioactive minerals is necessary. The latter may be classified as primary or secondary according to their geological age as compared with that of the parent rocks in which they occur, that is, where they appear to be of a later date they are regarded as secondary. In all analyses of uranium minerals, especially primary minerals, lead is always present, and hence is indicated as a final product, it being further noteworthy that the atomic weight of lead is almost identical with that of radium-G, if each radium change is accompanied by the evolution of an atom of helium. Thorium is also usually associated with uranium, and it has been suggested that possibly thorium is the parent substance of uranium; as, however, uranium minerals containing much thorium also contain much helium, the author considers it more probable that thorium is a disintegration product of uranium. Bismuth and barium are also indicated as final products and also probably actinium. It is remarkable that many radioactive minerals appear to



be hydrated, and many contain hydrogen (Ramsay, Collie, and Travers, *Trans.*, 1895, **67**, 686) when the conditions are such that penetration of water from without appears impossible, and hydrogen must therefore be regarded as a possible final product, whilst similar evidence suggests argon. The analyses of a number of samples of uraninite are given, and it is noteworthy that the highest proportions of lead and helium with respect to uranium are found in those primary minerals which occur in the oldest geological formations; and, further, that those containing the greatest proportion of thorium are generally the most hydrated. The author suggests the above as hypotheses deserving investigation rather than as definite conclusions.

L. M. J.

**Atomic Weight of Radium and the Periodic System.** HARRY C. JONES (*Amer. Chem. J.*, 1905, **34**, 467—471).—Evidence based on the periodic system is brought forward to demonstrate that the atomic weight of radium approaches 258, the value given by Runge and Precht (*Abstr.*, 1903, ii, 346), rather than 225, the value found by Madame Curie.

E. G.

**A New Element, Radiothorium, the Emanation of which is identical with that of Thorium.** Sir WILLIAM RAMSAY (*J. Chim. phys.*, 1905, iii, 617—624).—A Ceylonese mineral, which has been named thorianite (*Abstr.*, 1904, ii, 744, 745), was found to yield, on heating to redness, about 9 c.c. of helium per gram, that is, nearly four times as much as that obtained from cleveite. It also contained radium and thorium, but during their separation a new element was discovered, which differs from radium by forming a soluble sulphate and from thorium in forming an insoluble oxalate which is not soluble in excess of ammonium oxalate. This element was found to form radioactive salts, which give off an emanation identical with that of thorium. The identity is seen by the rate of decay and by equal period of induced activity. The oxide after heating is self-luminous and very rich in  $\beta$ -rays. The emanation is lighter than air, for the effect on a screen is more marked when the latter is above the salt than when it is below. The same obtains for the emanations of actinium and emanium, but the emanations are not the same. The radioactivity is very great, the emanation produced from a few mg. being equal to that given by 500,000 times the mass of thorium. The author hence considers it very probable that the radioactive power of thorium is to be attributed to small quantities of this element, radiothorium, and suggests the following series: (1) inactive thorium, (2) radiothorium, (3) thorium X, (4) emanation, (5) thorium A, (6) thorium B, (7) (1), (8) helium (see also following abstract).

L. M. J.

**A New Radioactive Element which gives rise to the Thorium Emanation.** OSKAR HAHN (*Ber.*, 1905, **38**, 3371—3375).—A continuation of experiments described previously (*Abstr.*, 1905, ii, 432; compare also preceding abstract). Details are given of the isolation of 10.9 mg. of an intensely active substance, *radiothorium*, which produces 700,000 times as much thorium emanation

per unit of time as is produced by thorium itself. Radiothorium is certainly not identical with thorium X, because it has a nearly constant radioactivity; it is also apparently chemically distinct from thorium itself. But its emanation is identical with the thorium emanation,  $\lambda$  having the value  $1.3 \cdot 10^{-2}$ , and the half value being reached after 53.3 seconds; the emanation is apparently a gas less dense than air, as it rises when produced. Radiothorium behaves like thorium in ceasing temporarily to give off its emanation when heated. It appears probable that radiothorium is the active constituent of ordinary thorium, being related to the latter in the same way as radium is related to uranium.

W. A. D.

**Thorium X and the Induced Thorioactivity.** F. VON LERCH (*Monatsh.*, 1905, 26, 899—929).—The induced thorioactivity, but not thorium X, is precipitated from the hydrochloric acid solution of thorium X by magnesium, iron, zinc, amalgamated zinc, nickel, lead, copper, or aluminium. The induced thorioactivity, sometimes along with traces of thorium X, is precipitated on electrolysis of acid thorium X solutions; but thorium X is precipitated along with metals from alkaline solutions. Precipitates, the activity of which diminishes to half of the initial value in more than 1 and less than 10.6 hours, contain thorium B and thorium A, the activities of which decay to half-value in 1 and 10.6 hours respectively. The amount of thorium B in a solution of induced thorioactivity is proportional to the amount of thorium A; whilst in a thorium X solution the amounts of thorium A and thorium B present are proportional to thorium X.

G. Y.

**Deflection of  $\alpha$ -Rays from Radium and Polonium.** A. STANLEY MACKENZIE (*Phil. Mag.*, 1905, [vi], 10, 538—548. Compare Rutherford, *Abstr.*, 1903, ii, 256).—The deviations of a beam of  $\alpha$ -rays in a magnetic and an electrostatic field have been measured. The beam of rays, after passing through two slits at one end of an exhausted vessel, traversed the field of force and was received at the opposite end on a glass plate coated on the inside with a thin layer of powdered zinc sulphide. The position of the incident beam was determined by placing a photographic plate in close contact with the outer side of this screen.

On account of the heterogeneous character of the  $\alpha$ -rays from radium, considerable dispersion takes place in a magnetic field.

If  $m$ ,  $e$ , and  $v$  denote respectively the mass, charge, and velocity of the  $\alpha$ -particles, the mean value obtained for  $mv/e$  for the middle line of the spectrum is  $3.0 \times 10^5$  C.G.S. electromagnetic units.

The observed electrostatic dispersion was considerably smaller than the electromagnetic, and the mean value of  $mv^2/e$  for the middle rays is  $4.11 \times 10^{14}$ . From these numbers,  $v$  (for the mean ray) =  $1.37 \times 10^9$  cm. per second, and  $m/e = 4.6 \times 10^3$  electromagnetic units. Allowing for the absorption by the mica plate separating the radium preparation from the slit tube, the velocities of the slowest, average, and fastest rays are 1.18, 1.45, and  $1.74 \times 10^9$  cm. per second. Assuming that the charge on the  $\alpha$ -particle is the same as that carried by the hydrogen atom, it follows that the mass of the former is 2.2 times

that of the latter and this suggests that the  $\alpha$ -particle is a hydrogen molecule.

From measurements of the deflexion of the  $\alpha$ -rays from polonium which exhibit no appreciable dispersion, the value of  $mv/e = 3.30 \times 10^5$ . Assuming  $m/e$  is the same as for the radium  $\alpha$ -particles, it follows that the velocity of the particles from polonium is greater than that of the average  $\alpha$ -particles from radium.

H. M. D.

**$\alpha$ -Particles of Radium.** W. H. BRAGG (*Phil. Mag.*, 1905, [vi], 10, 600—602. Compare Bragg and Kleeman, this vol., ii, 5; Rutherford, *ibid.*, 495).—The view expressed in a previous paper, that the whole of the energy of the  $\alpha$ -particles is spent before they cease to ionise, is corrected. Rutherford's experiments on radium-C indicate that only a portion of the energy is used up before this condition is reached. The particles, however, lose the power of ionisation at exactly the same speed in all gases. This is the only possible conclusion to be drawn from experiments on mixtures of gases. The data obtained in experiments on the amount of ionisation at different distances from the source of the  $\alpha$ -particles indicate that the ionisation varies inversely as the square of the velocity of the particles.

H. M. D.

**Emission of Negative Corpuscles by the Alkali Metals.** JOSEPH J. THOMSON (*Phil. Mag.*, 1905, [vi], 10, 584—590).—It has been found that the alkali metals emit negative corpuscles even when all external light is excluded. An evacuated vessel containing rubidium or an alloy of sodium and potassium and a well-insulated gold-leaf electroscope is enclosed in a light-tight box. The divergence of the leaves is measured by means of a reading microscope, passing through the side of the box, the leaves being momentarily illuminated by a faint light transmitted through a red glass window. During the intervals of illumination, the leak of the instrument is much greater than in the dark, but this part of the leak can easily be separated from the slower leakage taking place in the dark. When the gold leaves are charged with negative instead of positive electricity, there is no perceptible leak and the positive leak is also stopped by a transverse magnetic field. Traces of hydrogen produce a very large temporary increase in the rate of leakage; the emission of corpuscles is therefore greatly increased during the absorption of hydrogen by the alkali metals. No evidence of the emission of corpuscles is obtained from lead, silver, or mercury. When sodium is converted into vapour in an exhausted vessel containing two glass tubes down which run wires having a difference of potential of 600 volts, deposition of the sodium takes place almost entirely on the tube containing the negative wire, indicating that the sodium atoms are positively charged. The author supposes that most substances emit corpuscles under certain conditions and that the energy of these is derived from the atoms of the corpuscle-emitting substances. In the interior of a substance, the energy of the corpuscles is ultimately transformed into heat energy, and this should cause the interior of a mass of a substance to be hotter than the surface, the difference of temperature depending



on the amount of energy transformed, the size of the body, and its thermal conductivity. For a body of the size of the earth having a conductivity equal to 0.01, the value of this difference would be  $3000^{\circ}$  if the amount of atomic energy thus transformed into heat per cubic centimetre in 100 million years is approximately equal to the heat required to raise the temperature of 1 gram of water by  $1.5^{\circ}$ .

H. M. D.

**Method of Transmission of the Excited Activity of Radium to the Cathode.** WALTER MAKOWER (*Phil. Mag.*, 1905, [vi], 10, 526—532. Compare Rutherford, 1900, ii, 352).—The dependence of the amount of excited activity deposited in a given time on a negatively-charged rod exposed to a constant quantity of emanation on the pressure of the surrounding gas has been investigated. The deposited activity is independent of the difference of potential between the electrodes over a considerable range. At low pressures, the activity acquired diminishes as the pressure is decreased and varies with the distance between the electrodes. As this distance increases, the values of the pressure at which a diminution in the amount of deposited activity is observable become smaller. The experiments indicate that, at low pressures, the excited activity produced from radium emanation contained in a closed vessel is not confined to the cathode, but is distributed over the walls of the vessel and appears both on the anode and cathode even in a strong electric field. It is supposed that the excited activity at the moment of its production is unchanged, and that the collision of the particles with gas molecules results, in a certain percentage of cases, in the expulsion of electrons, leaving the excited activity positively charged. In accordance with this hypothesis, it is found that the activity deposited by a given quantity of emanation in a given time is not increased when the number of ions present in the containing vessel is increased by external means.

H. M. D.

**Method of Transmission of the Excited Activity of Radium to the Cathode.** W. H. JACKSON (*Phil. Mag.*, 1905, [vi], 10, 532—537).—It is shown that the deviations of the experimental results contained in the preceding paper from those required by the theory that the molecules of excited activity are initially uncharged, but become so in consequence of the collision with gas molecules, are actually less than the errors of observation.

H. M. D.

**Electrification produced by Radium Rays.** AUGUSTO RIGHI (*Nuovo Cim.*, 1905, [v], 10, 13—17).—The method of working adopted by the author consisted in charging a disc of the substance under examination at a feeble positive potential, for example, +0.4 volt, subjecting it to the action of  $\beta$ -rays from 0.015 gram radium bromide, and measuring the time required for the disc to assume a potential of -0.4 volt. The general result arrived at is that the variation of potential per unit of time decreases as the atomic weight of the element of which the disc is made increases. When the substance is in the form of very thin leaves, the charge acquired by it is virtually zero. Hence such thin leaves can be employed for pre-

paring a conducting coating for measuring the charges acquired by dielectrics on which radium rays impinge. T. H. P.

**Diminution of Resistance produced in Bad Conductors by Radium Rays.** AUGUSTO RIGHI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 207—214).—Under the influence of the  $\beta$ -rays from radium bromide, the resistance of light petroleum, oil of turpentine, carbon disulphide, benzene, or olive oil is considerably diminished; with light petroleum, the resistance is only one-sixth of its normal value. The effects obtained with solid dielectrics were small and uncertain. The apparatus used by the author is described. T. H. P.

**Increase of the Conductivity of Water by Radium Emanations.** UGO GRASSI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 281—284).—The water employed by the author was mixed with sulphuric acid and potassium permanganate and distilled through a tin condenser into a Jena glass vessel fitted with smooth platinum electrodes, by means of which the conductivity measurements were made. Hydrogen, charged with emanations from 0.002 gram of radium bromide, was passed through the water. In this way, the conductivity was lowered in three days to about one-third of its initial value—from  $3.4-3.5 \times 10^{-7}$  to about  $1 \times 10^{-7}$  reciprocal ohms at about  $23^\circ$ ; the latter value remained unchanged on further passage of the charged hydrogen. After the current of hydrogen was stopped, the conductivity of the water increased rapidly, but the amount of the increase was not constant and seemed to depend on the time during which the hydrogen remained in contact with the radium before being passed into the water. T. H. P.

**Measurement of Potentials in Iodine Vapour.** W. MATTHIES (*Sitzungsber. phys. med. Soc. Erlangen*, 1905, 37; reprint).—When a discharge passes through iodine vapour at low pressures in a Geissler tube, a beautiful orange-yellow luminescence is observed at the cathode. This light gives a continuous spectrum extending from red to green. The normal fall of potential at a platinum cathode in iodine vapour is 377 volts; this value is independent of pressure and of current strength. The fall of potential at the anode varies with the pressure and the current strength; the lowest value observed was 66.6 volts. J. C. P.

**Elimination of the Diffusion Potential between Two Dilute Aqueous Solutions by the Insertion of a Concentrated Solution of Potassium Chloride.** NIELS BJERRUM (*Zeit. physikal. Chem.*, 1905, 53, 428—440).—The author's experiments show that the use of a concentrated potassium chloride solution for the purpose stated in the title gives very satisfactory results. A formula is deduced for the diffusion potential between a concentrated potassium chloride solution and a dilute solution of a strongly dissociated binary electrolyte. J. C. P.

**Electrical Conductivity of Selenium.** MAURICE COSTE (*Compt. rend.*, 1905, 141, 715—717).—The usual method of converting the non-conducting vitreous form of selenium into the conducting metallic variety by fusing the vitreous form between two metallic plates and allowing it to cool slowly (compare Marc, *Abstr.*, 1903, ii, 105) is not satisfactory, since selenium combines with most of the metals, including gold, to form selenides; if, however, the metal plates are replaced by pure carbon, the complications due to the presence of the selenides are obviated. The conversion of vitreous silicon into the metallic variety is accompanied by a change in structure, the substance becoming more porous and not exhibiting a constant electrical resistance until after the lapse of some hours; thus, the resistance of a rod of selenium having the dimensions 90 mm.  $\times$  1 mm.  $\times$  0.5 mm. was 44,000 ohms immediately after conversion, 60,000 ohms after one hour, 63,500 ohms after two hours, 78,000 after twenty-four hours, and constant at 86,000 ohms after forty-eight hours. M. A. W.

**Temperature-coefficients of Conductivity in Aqueous Solutions and the Effect of Temperature on Dissociation.** HARRY C. JONES and AUGUSTUS P. WEST (*Amer. Chem. J.*, 1905, 34, 357—422).—A *résumé* is given of previous work on this subject.

A study has been made of the effect of temperature on dissociation between 0° and 35°; the temperature-coefficients of conductivity, expressed in percentage of conductivity units, have been calculated by means of the Kohlrausch formula, and the influence of temperature on these coefficients has been investigated.

The conductivity of aqueous solutions of the following substances at various concentrations and at temperatures between 0° and 35° has been determined. Ammonium chloride and bromide; sodium bromide, iodide, carbonate, and acetate; potassium chloride, bromide, iodide, nitrate, sulphate, carbonate, and ferrocyanide; potassium hydrogen sulphate; calcium chloride and bromide; strontium bromide; barium chloride; magnesium chloride; zinc sulphate; manganese chloride and nitrate; cobalt chloride and nitrate; nickel chloride and nitrate; copper chloride and nitrate; hydrochloric, nitric, sulphuric, and oxalic acids.

The results are given in tabular form, and include the molecular conductivities, comparison of these values with those obtained by other observers, the temperature-coefficients in conductivity units, the temperature-coefficients per cent., and the percentage dissociation. It is found that in all cases there is a large increase in conductivity due to increased ionic mobility, and that the percentage dissociation and the percentage temperature-coefficients of conductivity decrease as the temperature rises from 0° to 35°. The effect of temperature on the temperature-coefficients of conductivity, expressed in conductivity units, is different in the case of salts from that in the case of acids; with salts, they increase with rise of temperature, whilst with acids they decrease.

These results are shown to be in harmony with the observation of Ramsay and Shields (*Trans.*, 1893, 63, 1089), that the association of water becomes less as the temperature is raised, and with the hypo-



thesis of Dutoit and Aston (Abstr., 1897, ii, 546), which states that as the association of a solvent decreases, its dissociating power is diminished. The fact that the dissociation decreases with rise of temperature is also in agreement with the conclusions to be drawn from the results of Vonwiller (*Phil. Mag.*, 1904, [vi], 7, 655), showing a decrease in the dielectric constant of water with rise of temperature, and the Thompson-Nernst hypothesis connecting the dissociating power of a solvent with its dielectric constant. The temperature-coefficients of conductivity, expressed in percentage of conductivity units, decrease with rise of temperature, and this fact is in accordance with the maximum in the conductivity-temperature curve of an electrolyte as pointed out by Bousfield and Lowry (Abstr., 1903, ii, 52).

E. G.

**Electrolytic Dissolution of Platinum.** RUDOLF RUER (*Zeit. Elektrochem.*, 1905, 11, 661—681).—A platinum anode immersed in a solution of sulphurous acid or ferrous sulphate in 50 or 66 per cent. sulphuric acid is dissolved slowly by an intermittent current. The current must be strong enough and must pass for a sufficient length of time to impart a suitable anodic potential to the platinum; the interruption must be long enough to permit the reducing agents to diminish this potential below a certain point. Under similar conditions, a platinum cathode is dissolved in presence of a strong oxidising agent such as persulphuric or chromic acid. Alternate cathodic and anodic polarisation gives the same result. Measurements of the polarisation show that the anodic potential of at least  $-1.20$  volts (compared with a hydrogen electrode in sulphuric acid of the same strength) is required to give any dissolution of the platinum and that the dissolution increases as the potential increases; the alternate cathodic potential of  $-0.7$  volt gives the maximum dissolution. If the cathodic polarisation is pushed so far that the potential 0 is reached and hydrogen begins to be evolved, no platinum is dissolved.

A very careful repetition of the experiments of Brochet and Petit (this vol., ii, 673) showed that no dissolution whatever occurs with the current from an aluminium rectifier.

The whole of the results are readily explained by assuming the formation of a layer of platinum peroxide (Abstr., 1903, ii, 407). From the quantity of platinum dissolved by alternate anodic and cathodic polarisation, it is shown that the thickness of the layer of oxide is at least  $0.09 \times 10^{-6}$  mm., which is less than the diameter of a molecule.

T. E.

**Electromotive Behaviour of Dilute Amalgams.** J. F. SPENCER (*Zeit. Elektrochem.*, 1905, 11, 681—684).—Amalgams of zinc, cadmium, lead, thallium, and copper are prepared by electrolysis, and measurements of the *E.M.F.* between the amalgam and the pure metal in a normal solution of a metallic salt are made. The differences between the potentials of the amalgams can be calculated fairly well by means of Nernst's formula, assuming the molecule of the metal dissolved in the mercury to contain two atoms, except in the case of thallium, which is monatomic. Some of the amalgams of zinc and copper are less noble than the pure metals.

T. E.

**Electromotive Behaviour of Molybdenum and its Analogies with that of Chromium.** LUIGI MARINO (*Gazzetta*, 1905, 35, ii, 193—224).—Although molybdenum, like chromium, is capable of functioning as a bi-, ter-, or sexa-valent element, electrochemically it exists only in one degree of combination—the sexavalent. Molybdenum can, under widely varying conditions, occur in two different states, namely, active and passive. With these two states correspond two definite values of the *E.M.F.*, and between these values lie an indefinite number of others answering to the infinite number of conditions of the surface of the metal; the same has been shown by Hittorf to hold for chromium.

The metal is active when in contact with strongly oxidising solutions, such as those of chlorine, bromine, nitric acid, or chloric acid, at the ordinary temperature; further, it is active in solutions of highly oxygenated salts, but only at temperatures rising with the dilution, and also in concentrated solutions of certain other acids only capable of dissolving it at their boiling points, the *E.M.F.* being here identical with that exhibited in solutions able to dissolve it readily.

The inactive condition of the metal is only possible for certain values of the current density, a fact which indicates the great influence of the latter magnitude on the surface of the metal. This influence is shown most distinctly in solutions of substances rich in oxygen, such as nitric acid and nitrates.

Neglecting the slight influences exerted by different electrolytes, the highest value of the *E.M.F.* after the metal has acted for some seconds as a cathode is 1.50 volts for the active condition and 0.20 volt for the passive condition. The inactive state of the metal is unstable and, as soon as its cause is removed, reverts to the active condition, the change proceeding more rapidly than with chromium.

The behaviour of molybdenum lends support to Hittorf's idea, that a class of substances may exist the chemical energy of which is not transformable into electrical energy.

T. H. P.

**Cathode Potentials necessary for the Electrolytic Deposition of Certain Metals from Solutions of their Sulphates.** GIULIO COFFETTI and FRITZ FOERSTER (*Ber.*, 1905, 38, 2934—2944. Compare Küster, *Abstr.*, 1901, ii, 555).—The authors have determined the cathode potentials necessary for the electrolytic deposition of copper, cadmium, zinc, cobalt, nickel, and iron from normal solutions of their sulphates, using different current densities, a platinum cathode, and an anode of the metal in question, at 20°. The *E.M.F.* was measured against an *N/10* calomel electrode, the potential of which,  $\epsilon_h = -0.336$  volt. As cadmium is deposited irregularly from the solution of its sulphate, 10 per cent. of hydrofluosilicic acid was added to the electrolyte.

Hydrogen is evolved on electrolysis of very slightly acid solutions of iron, nickel, and cobalt sulphates; in these cases, the amount of metal deposited is given as a percentage of the current employed.

The variation of the cathode potential with the current density is shown by a series of tables and curves. The potentials necessary

form an ascending series, copper, cadmium, cobalt, nickel, iron, and zinc.

The results for nickel and iron agree with the values given by Muthman and Fraunberger for the difference of potential of these metals (*Sitzungsber., Bayer, Akad. Wiss.*, 1904, 34, 201). G. Y.

**Rate of Recombination and the Size of Gaseous Ions.** JOSEPH J. THOMSON (*Proc. Camb. Phil. Soc.*, 1905, 13, 170—173).—If two oppositely charged ions start from rest, their attraction will cause them to form one system, and they will cease to act as ions. If, however, the kinetic energy  $T$  of the ions is greater than  $e^2/r$ , where  $e$  is charge on the ions and  $r$  their distance, they will again separate, and hence for recombination the ions must approach to a distance  $r < e^2/T$ , and as  $T$  is dependent solely on temperature, this limiting distance is the same for all ions, and the value is calculated as  $1.4 \times 10^{-6}$  cm. From this value and that of the average distance between ions, the author calculates the value for the number of recombinations per second as  $n\pi r^2 V$  (where  $n$  is the number of ions) per unit volume. This equated to  $an^2$ , where  $a$  is the coefficient of recombination, leads to  $a = 1.5 \times 10^{-6}$  if the ions have the same mass as the molecules. This value, although of the same order, is slightly higher than the value obtained otherwise, so that the mass of the ion is somewhat greater than that of the molecule. In strong electric fields, it is clear that  $a$  will decrease considerably. The attraction of ions for uncharged molecules is next considered, and it is shown that in general the charged molecule will recombine and form a complex ion, but that this process of aggregation will be limited, and will stop at an earlier stage at high temperatures than at low ones. L. M. J.

**Faraday's Law in Reference to the Glow Discharge in Gases.** CLARENCE A. SKINNER (*Chem. Centr.*, 1905, ii, 1215; from *Physikal. Zeit.*, 6, 610—614).—In the apparatus used for the experiments on the glow discharge in gases, the anode was made of the sodium-potassium alloy NaK; the cathodes of various metals were used, and could be changed without being exposed to the atmosphere. When the tube was filled with helium, the pressure, measured by a Macleod manometer, was found to increase regularly owing to the liberation of hydrogen from the cathode. The quantity of hydrogen formed was at first in accordance with Faraday's law, but decreased after a time. Aluminium, bismuth, cadmium, copper, gold, lead, magnesium, nickel, platinum, silver, steel, tin, and zinc were found to behave in practically the same way. When the tube was filled with mercury which had been distilled in a vacuum and had not been exposed to the air, no hydrogen was evolved. Since, when the tube contained hydrogen, the pressure remained constant, the anode must have absorbed the gas as rapidly as it was evolved, but after saturation of the anode the pressure began to rise slowly. Zinc which had been distilled in a vacuum and exposed to air did not cause any decrease in the quantity of gas liberated; hydrogen was first formed and then nitrogen, and if air was allowed to enter the tube the evolution of gas again increased. When carbon electrodes were used and the tubes were freshly filled with helium, nitrogen was con-



tinuously liberated, together with a small quantity of hydrogen, and the quantities were approximately in accordance with Faraday's law. By allowing the apparatus to remain at rest, the electrodes recovered their former condition by a process of diffusion from the interior to the surface. When the tube was filled with nitrogen, the absorption of the gas by a carbon electrode was found to follow Faraday's law. In the phenomenon of glow discharge in gases, therefore, the current is carried from the commencement by means of the atoms of the gases.

E. W. W.

**Mercury Arc Lamp in Vessels of Fused Silica.** ERNST HAAGN (*Chem. Centr.*, 1905, ii, 803; from *J. Gasbel.*, 48, 613—614).—The properties of fused silica render it more suitable for the construction of mercury lamps than ordinary glass. The intense light emitted by the lamp has an unpleasant colour, and affects the skin like a frost-bite; it is rich in ultra-violet rays, which are transmitted more perfectly by silica than by glass. The spectrum consists of a few lines, and the red portion is totally absent. The oxygen of the air surrounding the lamp becomes ozonised. The use of amalgams offers no advantage. The light depends on the vaporisation of the metals, the lamp becoming filled with the vapour of those metals which have the lowest vapour tensions, whilst the less volatile remain at the electrodes. The arc behaves like a free conductor carrying a current, and is affected by a magnet, placing itself in a position which is perpendicular to the lines of force. Hall's phenomenon may be demonstrated more readily by means of the lamp than by any other method. If the lamp is cooled by water, the light becomes considerably richer in ultra-violet rays.

E. W. W.

**New Type of Electric Furnace, with a Redetermination of the Melting Point of Platinum.** JOHN A. HARKER (*Proc. Roy. Soc.*, 1905, A, 76, 235—250).—The essential part of the furnace is a tube of solid electrolytically conducting material, such as is used in the Nernst lamp. This tube, which is connected through a regulating resistance with the terminals of a 100—500 volt circuit, is placed centrally in a longer tube of hard porcelain or fire-clay, the space between the tubes being packed with pure zirconia powder. The outer tube is wound round with nickel wire, which is connected with an appropriate source of current, and acts therefore as a heating jacket. It was found that the control of the temperature in the inner tube between 800° and 2000° was so good that well-defined melting points could be obtained with very small quantities of substance. Thus, with a thermo-junction of bare platinum and platinum-rhodium or platinum-iridium, very concordant values were obtained for the melting point of the platinum which formed the junction. Many determinations were made, and the melting point of platinum is found to be  $1710^{\circ} \pm 5^{\circ}$ , a value considerably lower than the numbers previously found (for example, 1780°; see Holborn and Wien, *Abstr.*, 1896, ii, 87). The extrapolation to such a high temperature of the formula for the *E.M.F.* is justified by the fact that a good value is obtained similarly for the melting point of nickel.

J. C. P.

**Magnetic Qualities of Some Alloys not containing Iron.**

JOHN A. FLEMING and R. A. HADFIELD (*Proc. Roy. Soc.*, 1905, *A*, 76, 271—283).—An exact study of the magnetic properties of two alloys containing copper, aluminium, and manganese has been made. The first alloy contained Mn, 22·42 per cent.; Cu, 60·49 per cent.; Al, 11·65 per cent.; C, 1·5 per cent.; Si, 0·37 per cent.; Fe, 0·21 per cent.; intermingled slag (mostly MnO and SiO<sub>2</sub>), 2—3 per cent. The approximate composition of the second alloy was Mn, 18 per cent.; Cu, 68 per cent.; Al, 10 per cent.; Pb, 4 per cent. These alloys have poor mechanical properties, are brittle, and cannot be forged.

The first alloy exhibits magnetic properties analogous to those of a feebly ferromagnetic material. It exhibits the phenomena of magnetic hysteresis and of magnetic retentivity and coercivity. It is not merely magnetic, but can be permanently magnetised. The magnetic qualities of the second alloy are generally similar to those of the first alloy. These results lead the authors to conclude that the magnetic properties of these alloys must be based on a similarity of molecular structure with the familiar ferromagnetic metals. These metals are probably composed of molecular groups which are permanently magnetic; the process of producing or changing the evident magnetisation of a mass of these metals would then consist in arranging or disturbing the positions of these molecular magnets. The alloys examined by the authors are instances of fairly strong ferromagnetism produced by mixing non-magnetic metals, and hence it follows that ferromagnetism *per se* is not a property of the chemical atom, but of certain molecular groupings. If this is so, it may be possible to prepare alloys which are more strongly magnetic than iron itself.

J. C. P.

**The Thermo-electric Junction as a means of determining the Lowest Temperatures.** Sir JAMES DEWAR (*Proc. Roy. Soc.*, 1905, *A*, 76, 316—325).—A German silver-platinum thermocouple is found to be trustworthy as a thermometric agent at the lowest steady temperature that could be obtained. According to the indications of this instrument, the melting point of hydrogen is 15·7° absolute, and a temperature of 14·4° absolute can be reached by exhausting solid hydrogen. These are both mean values.

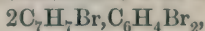
J. C. P.

**Relation of the Specific Heats of Crystalline Substances to Temperature.** ALEX. D. BOGOJAWLENSKI (*Chem. Centr.*, 1905, ii, 945—947; from *Schriften Dorpater Naturfor. Ges.*, 1904, 13, 1—73).—The specific heats of ten organic compounds which had been purified by crystallisation from different solvents, by fractional distillation, or by distillation in steam, have been determined at different temperatures by means of a mercury calorimeter. The specific heats of these compounds, with the exception of *p*-dibromobenzene and to some extent naphthalene, were found to increase considerably with rise of temperature. This abnormal behaviour is doubtless due to the presence of impurities, which cause the softening and partial liquefaction of these substances which was observed to take place at tempera-

tures below their melting points. This hypothesis was confirmed by the results obtained when the specific heats were determined by a "reversed" method in which the substance at the ordinary temperature was introduced into a heated calorimeter. For absolutely pure substances such a method should give higher values than the direct method, and this was found to be the case for *p*-dibromobenzene, naphthalene, quartz, topaz, and iron, but lower values were obtained for the other organic compounds. Tables showing the specific heats of *p*-dibromobenzene, *m*-chloronitrobenzene, benzil,  $\alpha$ -crotonic acid, phenylacetic acid, diphenylamine, *o*-nitrophenol, and naphthalene at temperatures above  $0^\circ$ , and of benzene, naphthalene, and ice at temperatures below  $0^\circ$ , are given in the abstract. The specific heat of pure compounds varies only slightly with temperature, and the function  $c=f(t)$  appears to be a linear one.

Experiments have also been made to determine the specific heats and temperatures of solidification of mixtures of *p*-dibromobenzene and naphthalene, sulphonal and benzil, and *p*-dibromobenzene and *p*-bromotoluene. The first mixture gives the simplest curves and showed eutectic points at  $47.6^\circ$  and  $80.4^\circ$ . The specific heats of the mixture not only increase rapidly with rise of temperature at temperatures considerably below that of solidification, but also show a sudden increase at a constant temperature. At this temperature, which is below the eutectic point, the specific heats of all the mixtures change suddenly. The remarkable constancy of the temperature is due to the actual presence of the eutectic mixture, the sudden rise of the specific heat on further heating being caused by the melting of the mixture. The Regnault-Neumann rule for the specific heat of mixtures of crystalline substances holds for the mixtures quoted up to temperatures near the eutectic point, and at temperatures above this the specific heats may be represented by a formula into which the heat of liquefaction enters.

The diagram which represents the relationship of temperatures of solidification to composition in the case of the mixture of *p*-dibromobenzene and *p*-bromotoluene is given in the abstract. The temperatures of solidification of all the mixtures lie above the melting point of *p*-bromotoluene ( $26.50^\circ$ ) and below that of *p*-dibromobenzene ( $87.05^\circ$ ), and these compounds therefore form solid solutions although they are not isomorphous; *p*-bromotoluene crystallises in rhombic and *p*-dibromobenzene in monoclinic crystals. The curves intersect at  $36.6^\circ$ , which is the transformation temperature corresponding with the change of the monoclinic into the rhombic crystals. The diagram is divided by the ordinates of this point into two portions, of which one embraces isomorphous mixtures of *p*-bromotoluene with the compound



and the other mixtures of *p*-dibromobenzene with the compound  $2C_7H_7Br, C_6H_4Br_2$ . The eutectic temperature of the latter mixtures appears to be  $36.6^\circ$ , and the specific heat of these mixtures increases suddenly at about  $30^\circ$ .

From the results of the experiments described above and the consideration of Spring and Kapp's work on lead-tin alloys, it is shown that the relationships of physical condition to temperature and com-



position may be deduced from calorimetric as well as from thermometric data. From the character and position of the points of change of direction of the curves of specific heats of binary mixtures, eutectic mixtures may be distinguished from mixtures of isomorphous and isodimorphous substances.

E. W. W.

### Studies with the Liquid Hydrogen and Air Calorimeters.

I. Specific Heats. II. Latent Heats. Sir JAMES DEWAR (*Proc. Roy. Soc.*, 1905, A, 76, 325—340).—With the aid of the calorimeter previously described, the author has determined the specific heats at low temperatures for a large number of substances. Diamond, graphite, and ice are dealt with in greater detail, and the specific heats for these substances are given in the following table :

	+18° to -78°.	-78° to -188°.	-188° to -252·5°.
Diamond .....	0·0794°	0·0190°	0·0043°
Graphite .....	0·1341	0·0599	0·0133
Ice .....	—	0·285	0·146

Further, the specific heat of ice for the range -18° to -78° is 0·463.

The latent heats of vaporisation of oxygen, nitrogen, hydrogen, and air at their respective boiling points have been determined by measuring the gas produced on introducing a known weight of lead into the liquid. The mean values obtained for oxygen, nitrogen, and hydrogen are 51·15, 50·4, and 123·1 calories respectively. The latent heat of vaporisation of air requires further investigation.

J. C. P.

**Latent Heat of Vaporisation of Carvacrol and Anethole.** WLADIMIR F. LUGININ (*J. Chim. phys.*, 1905, iii, 640—647).—The values for the specific heat and latent heat of vaporisation of carvacrol are found to be 0·5770 and 68·08 cal. respectively. The boiling point being 237·97°, the value for the latent heat leads to a Trouton constant of about 20 and hence indicates the absence of polymerisation. The corresponding values in the case of anethole are 0·5113, 71·5 cal., 235·2°, and 20·8, so that in this case also there is no polymerisation.

L. M. J.

**Relative Value of Calorimetric Methods.** JULIUS THOMSEN (*Zeit. physikal. Chem.*, 1905, 53, 314—316. Compare this vol., ii, 435, 571).—Polemical in reply to Berthelot (this vol., ii, 504).

J. C. P.

[Thermochemical Studies.] JULIUS THOMSEN (*J. pr. Chem.*, 1905, [ii], 72, 341—342. Compare this vol., ii, 231, 435, 571; Lagerlöf, *Abstr.*, 1904, ii, 382, 605; this vol., ii, 76).—Polemical. A detailed reply to Lagerlöf's objections to his criticisms (this vol., ii, 677).

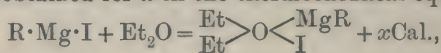
G. Y.

**Heats of Mixture of Acids.** EMIL BOSE (*Chem. Centr.*, 1905, ii, 947—948; from *Physikal. Zeit.*, 6, 548—553).—The curves which represent the relationship between the heats of mixture and the percentage composition of binary mixtures generally show a distinct change of curvature. If the percentage of water or other independent variable is taken as ordinate, the first portions of the curves are almost

hyperbolic. The data for dilute solutions, however, do not show this relationship (compare von Steinwehr, *Abstr.*, 1901, ii, 641). Thomsen's data may be represented by an equation:  $y = ax + bx^2 + cx^3$ , in which  $y$  is a function of the percentage of one of the components of the mixture. This equation holds with fair accuracy in the case of hydrochloric, hydrobromic, hydriodic, formic, acetic, phosphoric, nitric, and sulphuric acids; the halogen acids and the organic acids seldom show a difference of more than 1 per cent. Whilst the formula gives better results for dilute solutions of nitric acid than Thomsen's formula, it offers no advantage in the case of sulphuric acid. Formulæ for the molecular heat of mixture and molecular heat of dilution are also given in the original paper, and the peculiar character of the curves which represent the relationships of heat-tone to percentage of water for solutions of acetic acid and formic acid is also referred to. E. W. W.

**Conversion of Organo-magnesium Compounds into Grignard-Baeyer Oxonium Compounds and the Thermochemical Investigation of this Reaction.** WLADIMIR TSCHELINZEFF (*Ber.*, 1905, 38, 3664—3673).—The organo-magnesium compounds were prepared in benzene or light petroleum solutions by the addition of about five drops of dimethylaniline (to act as a catalyst; see this vol., i, 40), and were afterwards mixed with dry ether in a calorimeter.

The values obtained for  $x$  in the thermochemical equation,



are as follows:

R.	C <sub>2</sub> H <sub>5</sub> .	nC <sub>3</sub> H <sub>7</sub> .	isoC <sub>4</sub> H <sub>9</sub> .	isoC <sub>5</sub> H <sub>11</sub> .	
$x$ .....	+12·7	+12·6	+13·3	+12·5	In benzene
$x$ .....	—	+12·2	—	+12·0	In light petroleum

The same values for  $x$  have been obtained by using the solid organo-magnesium compounds as by using light petroleum solutions.

J. J. S.

**Specific Heats and Latent Heats of Fusion of Potassium and Sodium.** ARCIERO BERNINI (*Nuovo Cim.*, 1905, [v], 10, 5—13).—The author's measurements show that: (1) the specific heat of Thuringian glass increases rapidly with rise of temperature and proportionately with the latter between 0° and 100°. (2) The specific heats of sodium and potassium also increase considerably with rise of temperature, the increase being greater for sodium than for potassium (compare Behn, *Abstr.*, 1900, ii, 259). The latent heat of fusion of potassium is 13·61, and that of sodium 17·75 calories. T. H. P.

**Modified Gintl Pyknometer.** M. RAKUSIN (*Chem. Zeit.*, 1905, 29, 1087).—A slight alteration of the pyknometer used by Gintl for taking the sp. gr. of semi-liquid or very soft fats or similar substances. The bottom of the glass cylinder holding the fat is removed and a movable bottom is provided. In this way it is easier to save the fat and to clean the apparatus. L. DE K.

**Determination of Vapour Densities at High Temperatures.**  
**III. Disintegration of Iridium by Carbon Dioxide.** Dissociation of Carbon Dioxide. FRIEDRICH EMICH (*Monatsh.*, 1905, 26, 1011—1020. Compare Abstr., 1904, ii, 14; this vol., ii, 441; Holborn and Henning, Abstr., 1902, ii, 664).—Bunsen's method for the determination of vapour densities at high temperatures is applicable only to gas under relatively high pressures.

The author has determined the loss in weight (disintegration) of strips of iridium heated, in carbon dioxide and in nitrogen containing oxygen, by an electric current to various temperatures which were measured by means of a Holborn and Kurlbaum's optical pyrometer. No loss of weight occurs when iridium is heated in nitrogen or carbon monoxide. At 1500°, the loss of weight when iridium is heated in nitrogen containing 2·2 per cent. of oxygen is thirty times the loss in carbon dioxide, but at 1970° the loss in carbon dioxide and in nitrogen containing 2·2 per cent. of oxygen is approximately the same, whilst at 2150° the loss of weight in carbon dioxide is equal to the loss in nitrogen containing 5 per cent. of oxygen. The dissociation at various temperatures of carbon dioxide obtained from these results is compared with the dissociations calculated by Le Chatelier (Abstr., 1889, 205) and Trevor and Kortright (Abstr., 1895, ii, 211):

Temperatures.	Found. About	Percentage dissociation of carbon dioxide.	
		Le Chatelier.	Trevor and Kortright.
1500°	0·1	0·8	1
1970	4·5	4·0	8
2150	10·11	9·0	14

The disintegration of iridium in oxygen is due probably to the formation of an oxide which is volatile at high temperatures. G. Y.

**Viscosity of Liquid Mixtures at their Boiling Points.** ALEXANDER FINDLAY (*Chem. News*, 1905, 92, 206).—The viscosity of the binary mixtures benzene—carbon tetrachloride, benzene—alcohol, acetone—chloroform, and benzene—methyl alcohol, determined at their respective boiling points, in the hope that some relationship might be discovered between the viscosity composition-curve and the boiling point composition-curve, but this has been only partially realised.

D. A. L.

**Influence of Phase Changes on the Tenacity of Ductile Metals at the Ordinary Temperature and at the Boiling Point of Liquid Air.** GEORGE T. BEILBY and H. N. BEILBY (*Proc. Roy. Soc.*, 1905, A, 76, 462—468. Compare Abstr., 1904, ii, 647).—The observations recorded in the paper, which hardly lends itself to abstraction, are intended to prepare the way for a more direct attack on the problems of molecular cohesion.

J. C. P.

**Equilibria between Solid and Liquid Phases in Ternary Systems which are Pseudo-binary. Explanation of Anomalous Fusion and Solution Phenomena.** H. W.



BAKHUIS ROOZEBOOM and A. H. W. ATEN (*Zeit. physikal. Chem.*, 1905, 53, 449—501).—A theoretical paper. J. C. P.

**Ternary Equilibria.** FRANS A. H. SCHREINEMAKERS (*Chem. Centr.*, 1905, ii, 1066; from *Chem. Weekblad*, 1, 329—337).—The original paper consists of an introduction to the graphic method of representing equilibria in ternary systems and short descriptions of methods of investigation. E. W. W.

**Equilibrium of the Electrolytic Dissociation of Partially Neutralised Acids and Bases.** YUKICHI OSAKA (*Mem. Coll. Sci. Eng. Kyōto*, 1904—5, 1, 103—113. Compare Dawson, *Trans.*, 1903, 83, 725).—It is shown that if a weak monobasic acid is half-neutralised by a strong monoacid base, the concentration of the hydrogen ions is equal to the dissociation constant of the acid and independent of the dilution of the solution. If a mixture of two weak monobasic acids in equivalent proportions is half neutralised by a strong monoacid base, the hydrogen ion concentration is equal to the square root of the product of the dissociation constants of the two acids. The conclusion is also reached that a solution of the acid salt of a dibasic acid,  $H_2A$ , may be considered as a half-neutralised mixture in equivalent proportions of the acids  $H(HA)$  and  $HA$ . Similar relationships hold for partially neutralised weak bases. According to experiments of the author recorded previously on the bi-rotation of dextrose under the influence of ethylenediamine monohydrochloride, the velocity of the process increases with the concentration of the salt, whereas according to the above theoretical deductions it should be constant. These experiments have been repeated, and the different values for the velocity constant are now found to be more nearly equal. At dilutions of 400, 200, and 100 litres per mol., the values of the constant are 0.0126, 0.0147, and 0.0161 respectively. The mean value of the  $OH'$  concentration is calculated from these numbers to be  $1.1 \times 10^{-6}$ , and, utilising Bredig's number,  $8.5 \times 10^{-5}$ , for the dissociation constant of the first hydroxyl dissociation, the constant for the dissociation of the second hydroxyl is  $1.4 \times 10^{-8}$ . H. M. D.

**Kinetics of Processes of Oxidation.** ANTON SKRABAL (*Zeit. Elektrochem.*, 1905, 11, 653—656).—As a guide to the mechanism of a reaction, the law of the primary formation of the least stable product is assumed. In cases of oxidation, this primary oxide is one which may decompose into a higher and a lower oxidation product. For example, sulphur dioxide, aldehyde, and hypiodous acid are the first products of oxidation of sulphur, alcohol, and hydriodic acid respectively. In homogeneous systems, the labile primary oxide is approximately in equilibrium both with the reacting materials and with the final products (Brunner, this vol., ii, 511). The fact that in cases of induced oxidation the quantity of induced oxidation bears a simple relationship to the quantity of primary oxidation leads the author to suppose that the intermediate oxide must always be very nearly in equilibrium with the final products of the reaction. In case the intermediate

oxide is formed by the first reaction too quickly to allow of the fulfilment of this condition, another, less stable, set of final products is formed.

The oxidation of oxalic acid by permanganate is taken as an example. Permanganate and oxalic acid react very slowly; complex manganic oxalate ions decompose at a measurable rate into manganous ions and carbon dioxide; permanganate and oxalic acid react very rapidly in presence of manganous ions. The slow decomposition of the complex manganic oxalate ions is ascribed to the action of manganic ions, formed by the dissociation of the complex ions, on oxalic acid. The very rapid reaction between permanganate, manganous ions, and oxalic acid is due to the primary formation of manganic ions from the manganous ions and permanganate. T. E.

**Velocity of Decomposition of Nitrous Oxide.** MATTHEW A. HUNTER (*Zeit. physikal. Chem.*, 1905, 53, 441—448).—Nitrous oxide was passed in a continuous current, at different rates in different experiments, through a porcelain tube heated electrically and kept at a high temperature. The extent to which the gas had decomposed during its passage through the hot tube was deduced from the density of the issuing gas, determined in a gas balance. Experiments were made at 713°, 805°, and 895°, and it was found that the course of decomposition is nearly that required for a bimolecular reaction. The influence of moisture on the rate of decomposition is not appreciable. The influence of temperature on the velocity-coefficient  $k$  is given by the equation  $\log k = -31800/T + 24.12$ .

It is shown that platinum electrodes are not polarised by nitrous oxide; a computation, however, makes it probable that the oxidation potential is about 0.39 volt higher than that of oxygen. J. C. P.

**Mechanism of the Reaction by which  $\gamma$ -Hydroxy-acids are Converted into Lactones.** BALTHASAR R. DE BRUYN (*Chem. Centr.*, 1905, ii, 1016; from *Chem. Weekblad*, 2, 557—563).—Whilst Henry's (Abstr., 1892, 1303) theory of the decomposition of  $\gamma$ -hydroxy-acids into lactones agrees with the facts, Visser's (this vol., ii, 571) appears to be quite irreconcilable with them. The formation of lactone follows the law of mass action. Since, at the concentration employed, 99 per cent. of the hydroxy-acid is not dissociated, the addition of an acid cannot have any appreciable effect on the dissociation. Visser's explanation does not account for the accelerating effect of strong acids or of the opposing influence of salts of hydroxy-acids. Henry's assumption of the catalytic action of the hydrogen ions, however, cannot be considered to afford a satisfactory explanation. E. W. W.

**Control Experiments [over Long Periods of Time].** MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1905, [viii], 6, 195—199).—Pure nitric acid remains colourless when kept in sealed tubes in the dark for seven years, and silver oxide moist or dry also remains unaltered under similar conditions. A mixture of 9 vols. of carbonic oxide and 6 vols. of oxygen either dry or moist undergoes no change when kept in sealed tubes for more than seven years.

Soils which have been sterilised and kept in closed vessels contain the same proportion of nitrogen at the end of twenty years as they did at the beginning (compare Abstr., 1886, 175 ; 1887, 395, 617).

M. A. W.

**Absorption of Carbon Dioxide by Aqueous Salt Solutions and Binary Liquid Mixtures.** A. CHRISTOFF (*Zeit. physikal. Chem.*, 1905, 53, 321—340).—The order of a number of salt solutions, arranged according to their ability to dissolve carbon dioxide, is in general the same as the order deduced from their absorptive power for other gases (compare Setschenoff, Abstr., 1889, 1044 ; Rothmund, Abstr., 1900, ii, 467). Solutions of alums dissolve carbon dioxide to about the same extent as the solutions of the simple sulphates which they contain. Solutions of the acid salts  $\text{KHSO}_3$ ,  $\text{KHSO}_4$ ,  $\text{KH}_2\text{AsO}_4$ ,  $\text{KH}_2\text{PO}_4$ ,  $\text{K}_2\text{HAsO}_4$ ,  $\text{K}_2\text{HPO}_4$ , absorb less carbon dioxide than water does. The curves showing the variation of the solubility of carbon dioxide in binary mixtures with the composition of the mixtures may exhibit a minimum, as in the case of sulphuric acid and water, or a maximum, as in the case of acetic acid and carbon tetrachloride. The surface tension curve for these binary mixtures seems to exhibit a maximum where the solubility curve exhibits a minimum and *vice versa* (compare Skirrow, Abstr., 1902, ii, 600). The amount of carbon dioxide absorbed by solutions of borates and ortho- and metaphosphates is less than that calculated on the assumption that a whole molecule of hydrogen carbonate is formed from a molecule of the salt (compare Grünhut, Abstr., 1904, ii, 615).

J. C. P.

**Velocity of Dissolution of Solid Substances.** LUDWIK BRUNER and STANISLAW TOLLOCZKO (*J. Chim. phys.*, 1905, 3, 625—639).—It has been found by Noyes and Whitney that the velocity of dissolution of a solid in its own solution is given by the expression  $dx/dt = C(S - x)$  where  $x$  is the concentration of the solution and  $S$  that of the saturated solutions (Abstr., 1897, ii, 479), and experiments of the authors confirmed this result (Abstr., 1904, ii, 117). Schürr has found, however, that  $S$  and  $x$  should be replaced by their logarithms, the expression of Noyes and Whitney being only valid, therefore, when the solubility is small (Abstr., 1904, ii, 543). The authors criticise Schürr's work, and have determined the velocity of solution in the case of sodium chloride. The method of working is described ; the results obtained are in complete accord with the law of Noyes and Whitney.

L. M. J.

**Formation of Complexes: Hydration and Colour.** FREDERICK G. DONNAN (*Zeit. physikal. Chem.*, 1905, 53, 317—320).—In reference to the papers by Lewis (this vol., ii, 509) and by Jones and Bassett (*ibid.*), it is shown how inadequately these authors interpret the colour changes exhibited by cobalt and copper salts in the light of modern theory and recent experimental work. In this connection, special reference is made to the views of Werner (Abstr., 1893, ii, 379) and of Abegg and Bodländer (Abstr., 1899, ii, 542), and to the work of Donnan and Bassett (Trans., 1902, 81, 939) and of Kohlschütter (Abstr., 1904, ii, 338). The application of these modern conceptions to



the interpretation of the relative colours of complex or double salts is attempted by the author for a number of cases in which cupric chloride or bromide is one constituent. Thus :

$\text{LiCl}, \text{CuCl}_2, 2\text{H}_2\text{O}$	$\equiv [\text{Li}, 2\text{H}_2\text{O}]' [\text{Cu}, 3\text{Cl}]'$	is ruby-red ;
$\text{NH}_4\text{Cl}, \text{CuCl}_2$	$\equiv [\text{NH}_4]' [\text{Cu}, 3\text{Cl}]'$	is red ;
$\text{NH}_4\text{Cl}, \text{CuCl}_2, 2\text{H}_2\text{O}$	$\equiv [\text{NH}_4]' [\text{Cu}, 2\text{H}_2\text{O}, 3\text{Cl}]'$	is blue ;
$2\text{KCl}, \text{CuCl}_2, 2\text{H}_2\text{O}$	$\equiv [\text{K}]_2' [\text{Cu}, 2\text{H}_2\text{O}, 4\text{Cl}]''$	is blue ;
$\text{KCl}, \text{CuCl}_2$	$\equiv [\text{K}]' [\text{Cu}, 3\text{Cl}]'$	is brownish-red.
Again, $\text{HBr}, \text{CuBr}_2, 2\text{H}_2\text{O}$	$\equiv [\text{H}, 2\text{H}_2\text{O}]' [\text{Cu}, 3\text{Br}]'$	is brownish-red ;
$2\text{NH}_4\text{Br}, \text{CuBr}_2, 2\text{H}_2\text{O}$	$\equiv [\text{H}, \text{NH}_3]_2' [\text{Cu}, 2\text{H}_2\text{O}, 4\text{Br}]''$	is emerald-green ;
$\text{KBr}, \text{CuBr}_2$	$\equiv [\text{K}]' [\text{Cu}, 3\text{Br}]'$	is brownish-red ;
$2\text{LiBr}, \text{CuBr}_2, 6\text{H}_2\text{O}$	$\equiv [\text{Li}, 3\text{H}_2\text{O}]_2' [\text{Cu}, 4\text{Br}]''$	is brownish-red.

J. C. P.

**Do Crystals Soften in the Neighbourhood of their Melting Point?** N. SLATOWRATSKY and GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1905, 53, 341—348).—The plasticity of naphthalene and yellow phosphorus has been determined at various temperatures up to their melting points by a method previously described (*Ann. Physik*, 1902, 7, 198). The plasticity of ordinary samples of naphthalene increases markedly in the neighbourhood of the melting point, but this increase is largely due to the presence of impurities ; as these get pressed out and the crystals become chemically homogeneous, the plasticity falls off rapidly, and the temperature interval over which the naphthalene crystals appear to soften becomes much smaller. The question whether absolutely pure crystals would give any indication of softening has not been definitely answered.

J. C. P.

**The Linear Force of Growing Crystals.** GEORGE F. BECKER and ARTHUR L. DAY (*Proc. Washington Acad. Sci.*, 1905, 7, 283—288).—A weighted plate of glass was placed over a crystal of alum growing from solution. It was found that a crystal 1 cm. in diameter would raise a kilogram through a distance of several tenths of a millimetre. Similar results were obtained with other salts—copper sulphate, potassium ferrocyanide, and lead nitrate. The crystals grow with a cupped surface, and only a very narrow ring of material is in contact with the glass. The actual area of contact it was impossible to estimate, but it is so small that the force exerted by the growing crystal must amount to many pounds per square inch, being of the same order of magnitude as the resistance which the crystal offers to crushing stresses.

Attention is drawn to the geological importance of this force of crystallisation, especially in connection with the formation of quartz-veins and ore-deposits. If in quartz the force exerted during crystallisation on the walls of the vein is comparable with the resistance which the material offers to crushing, then it must be considerable.

L. J. S.

**Theory of Dyeing. II. Quantitative Experiments on the Formation of Inorganic Analogues of the Substantive Dyes.** WILHELM BILTZ and KURT UTESCHER (*Ber.*, 1905, 38, 2963—2973. Compare *Abstr.*, 1904, ii, 392 ; van Bemmelen, *Abstr.*, 1900, ii, 466).—Molybdenum-blue is obtained as a dark blue, amorphous mass when

a solution of molybdic acid, prepared by dissolving ammonium molybdate in the calculated quantity of dilute sulphuric acid, is reduced with hydrogen sulphide, freed from electrolytes by dialysis, and evaporated to dryness.

Comparative dyeing experiments have been carried out with cotton-wool and silk with molybdenum-blue, and with cotton-wool with vanadium pentoxide and benzopurpurin; the results are expressed in curves, which are drawn with the percentage of dye in the bath as abscissæ and the grams of dye absorbed by one gram of fibre as ordinates.

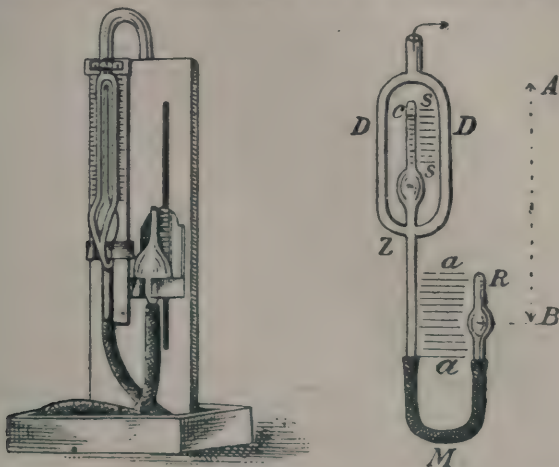
Similar absorption results are obtained with aluminium hydroxide and molybdenum-blue, colloidal silver, or benzopurpurin. G. Y.

**Theory of Dyeing. III. State of Affinity of some Sulphur Dyes.** WILHELM BILTZ and PAUL BEHRE (*Ber.*, 1905, 38, 2973—2977. Compare preceding abstract; *Abstr.*, 1904, ii, 324).—When dialysed for ten to fourteen days, solutions of "immedial" sulphur dyes in aqueous alkali sulphides form pure colloidal solutions, which, with the exception of the solution from "immedial yellow," are clear, and contain 0.096, 0.076, and 0.109 gram of immedial direct blue, bordeaux, and black respectively. These hydrosols resemble those previously investigated, especially in their capacity to form adsorption compounds. They are precipitated by electrolytes, are non-conductors of electricity, but under the influence of an *E.M.F.* of 110 vols. are attracted towards the anode, and therefore form adsorption compounds with positively charged hydrosols. Adsorption compounds are formed also with cotton-wool and aluminium, zirconium, ferric and stannic hydroxides.

G. Y.

**Measurement of High Vacua in Chemical Distillation.** HERMANN J. REIFF (*Chem. Centr.*, 1905, ii, 1065—1066; from *Chem. Zeitschr.*, 4, 426—427).—The glass tube, *R*, and the rubber tube, *M*, of the compression manometer, which is shown in the sketch, are filled with mercury. In order to estimate the total pressure under which a distillation at reduced pressure is being conducted, the upper end of the manometer is connected with the distilling apparatus, and the difference of level of the mercury in the tubes *MR* and *MZ* is read by means of the scale *a, a*. If *R* is now raised from *B* towards *A*, the mercury rises in the tubes *D, D* and in *c*, but, since *c* is closed at one end, the rising of the mercury in this tube is impeded by the air contained in it. The capillary tube, *c*, is graduated, so that the volume of the gas may be read to a small fraction of its original volume. The difference of level of the mercury in *D, D* and in *c* is read on the scale *s, s*, and corresponds with the pressure under which the air in *c* is confined. If the capillary tube, for example, is graduated to 1/10,000 of the total volume and an observation shows that a pressure of *m* mm. of mercury is required to compress the gas to *n*/10,000 of its original volume, then the pressure of the air is *mn*/10,000 mm. of mercury. From theoretical considerations, which are given in the original paper, it is shown that the pressure of the air which is read in this way is equal to that of the partial pressure

of the air in the distillation apparatus to which the manometer is attached, and is not affected by the saturated vapour or vapours which are present. If the first reading of the total pressure is  $G$  mm. and



the second reading of the partial pressure of the air is  $L$  mm., then the partial pressure of the vapour in the distilling apparatus is  $G - L$  mm. E. W. W.

**Two Manometers of Great Sensitiveness for Small Pressures and a Gas Balance.** E. GRIMSEHL (*Chem. Centr.*, 1905, ii, 941—942; from *Zeit. physikal.-chem. Unterr.*, 18, 198—202).—A sensitive manometer may be made of a U-shaped glass tube, both limbs of which terminate in bulbs. One limb contains coloured water and the other turpentine oil. When the former is connected with a gas under pressure by means of the side-tube which is fused on to the bulb, the water meniscus moves through an appreciable distance even when the pressure is small.

A similar manometer consists of two bulbs connected by a horizontal glass tube. To one bulb is attached a small glass tap and a side-tube. The apparatus contains a liquid, and in the horizontal tube there is a small bubble of air which is moved by a little pressure.

The gas balance consists of a long vertical tube to which a side-tube is attached at a point a short distance from the lower end. At the junction of these tubes there is a 3-way cock. The tube may be filled with gas by means of the side-tube, and the weight of the column of gas compared with a similar column of air by connecting the lower end of the vertical tube with either of the manometers described above.

E. W. W.

**Causes why an Element often Passes from One Grade of Combination to another without giving rise to Intermediate Compounds.** GEOFFREY MARTIN (*Chem. News*, 1905, 92, 185—187).—A theoretical paper. An element passes from one grade of com-



bination to another without giving rise to intermediate compounds when the latter are less stable under the conditions of experiment than the final product, and a relationship between this relative stability and valency is indicated.

D. A. L.

**Gaseous Permeability of Vitreous Substances. Use in Chemistry, and Permeability, of Fused Silica Vessels. Permeability of Glass Vessels. Use of the Hot and Cold Tube in the Study of Chemical Reactions.** MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1905, [viii], 6, 145—146, 146—164, 164—173, 174, 195).—A résumé of work already published (compare this vol., ii, 308, 316, 378, 386, 443).

M. A. W.

**Chemical Lecture Experiments.** JULIUS LANG (*Chem. Centr.*, 1905, ii, 948—949; from *Zeit. physikal.-chem. Unterr.*, 18, 202—206).—Simple lecture experiments are described which show (1) the preparation of sulphuric acid by the contact process, (2) the solidification of gases by means of liquid air, (3) the combustion of hydrogen in air or oxygen and the reversal of the flame, (4) the combustion of phosphorus in oxygen, the increase of weight of the phosphorus and the decrease of volume of the oxygen, and (5) the combustion of oxygen in hydrogen phosphide and of hydrogen phosphide in oxygen, and the reversal of the flame. In experiment (1), the sulphur trioxide is condensed in a test-tube surrounded by ice contained in an outer glass vessel. In experiment (2), the solidification of chlorine, hydrogen sulphide, sulphur dioxide, carbon dioxide, ethylene, acetylene, or cyanogen can be readily shown by means of the same condenser cooled by liquid air. The test-tube is in this case replaced by a Dewar tube. The combustion of hydrogen in oxygen, and oxygen in hydrogen, is also shown in the condenser, which in this case is cooled by water. In experiment (4), the flask in which the phosphorus is burnt in oxygen is connected with a graduated glass tube, the open end of which is placed in coloured water. In the last experiment, the gas evolved from calcium phosphide and water is in one case made to enter a cylinder containing oxygen, whilst in the other oxygen is led into a cylinder containing hydrogen phosphide.

E. W. W.

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## Inorganic Chemistry.

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**Determination of the Density of Chlorine at High Temperatures.** MAX REINGANUM (*Chem. Centr.*, 1905, ii, 808; from *Physikal. Zeit.*, 6, 514—516).—The density of chlorine has been determined at high temperatures by means of an apparatus which consists of a small air thermometer with a vertical quartz capillary tube to which is connected a cooled air vessel with a bent delivery tube. By means of capillary tubes and 3-way cocks, the upper portion of the apparatus

may be filled with dry air and the lower with the gas to be examined. The vessel in which the air is collected is weighed. The apparatus is similar to Victor Meyer's, except that the volume of the dissociated gas is limited. The degree of dissociation is calculated from the difference between the results obtained for air and for the gas at the same temperature. The quartz vessel is heated by means of a Heraeus electric furnace. Since chlorine is liable to diffuse and escape, a temperature corresponding with a faint red heat is chosen for comparison instead of the ordinary temperature. At a temperature of  $1137^{\circ}$ , there was no evidence of the dissociation of chlorine.

E. W. W.

**Distribution of Iodine between Two Solvents.** YUKICHI OSAKA (*Mem. Coll. Sci. Eng. Kyōto*, 1904—5, 1, 93—102. Compare Hantzsch and Vagt, *Abstr.*, 1902, ii, 8; Jakowkin, *Abstr.*, 1896, ii, 295).—By application of the law of mass action it is shown that the ratio of distribution of a substance between two phases must be constant and independent of the concentration, even when the dissolved substance combines with the solvent, provided the solutions are dilute. The explanations advanced to account for the variation of the ratio of distribution of iodine between different pairs of solvents with the concentration are shown to be improbable. To obtain further information, the distribution of iodine between aqueous alcohol and carbon disulphide was investigated at  $25^{\circ}$ , these two solvents being practically immiscible if the amount of alcohol present is less than 47.9 per cent. For a given alcohol-water mixture the ratio of distribution is independent of the iodine concentration and of the relative amounts of the two phases, and the variation of this ratio with the composition of the aqueous alcohol is given by the following numbers :

Grams of alcohol

in 100 c.c. of mixture	30.5	26.7	22.9	19.1	15.3	11.4	7.6
$(C_{\text{aq. alcohol}}/C_{\text{CS}_2}) \times 10^2$ .....	1.29	0.76	0.49	0.34	0.28	0.23	0.20

The distribution data are compared with the data for the solubility of iodine in aqueous alcohol and carbon disulphide and the conclusion drawn that the ratios are very nearly identical.

H. M. D.

**New Methods of Producing Ozone by means of Electricity.** OSCAR KAUSCH (*Chem. Centr.*, 1905, ii, 806—807; from *Elektrochem. Zeit.*, 12, 91—96).—In Blockmarr and Wilford's apparatus, a wire is wound round the exterior of a cylinder of glass or other similar material and a second wire wound similarly on the inner surface, but in fewer coils. The wires are made the poles of the secondary circuit of an induction coil and the battery with which this is connected also works an electric fan by means of which air is forced through the tube. By sealing or partially closing the lower end of the glass tube, the pressure may be increased and the yield of ozone improved.

In Déchaux's apparatus, a large discharging surface is used in a small space and the temperature is kept low. A large number of ozonisers, each consisting of a glass tube fitted between two metal

tubes, are arranged in a box. The metallic tubes, which have a hexagonal or polygonal section and are fitted symmetrically about the glass tube, are connected with the poles of an electric machine and the inner tubes are cooled by means of a liquid. The air is dried and cooled before entering the apparatus.

The apparatus of the *Compagnie française de l'ozone* consists of a hermetically-sealed chest divided into two sections and containing a large number of systems of the type glass with tinfoil | air | metal | air | tinfoil with glass (Otto's system). The glass plates are connected to earth and all portions carefully insulated from one another. The air is cooled by means of liquid air.

In the apparatus of the *Ozon Maatschappij* in Amsterdam (Vosmaer's system) a condenser is inserted as a shunt in the secondary circuit of the transformer, and in the main circuit a self-induction coil. By raising the secondary *E.M.F.* by this means to a maximum, conditions favourable for the dark discharge are attained and when the distance of discharge is 13 mm. an *E.M.F.* of 9500 volts may be reached without any visible spark discharge. No dielectric is inserted between the electrodes.

E. W. W.

**Action of Sodium Thiosulphate on Metallic Compounds in the Dry Way.** FRANZ FAKTOR (*Chem. Centr.*, 1905, ii, 1218—1219; from *Pharm. Post.*, 38, 527—529. Compare Abstr., 1905, ii, 452).—In the experiments from which the following conclusions have been deduced, a mixture of one part of the metallic compound with five of anhydrous sodium thiosulphate is strongly heated in a porcelain crucible and finally calcined. In the case of manganous chloride, sulphur and sulphur dioxide are evolved. The green residue gives off hydrogen sulphide when treated with hydrochloric acid and the solution formed by extracting with water and filtering contains sulphate, sulphide, and chloride. If the mixture is heated for 20 minutes after it has formed a uniform fused mass, the compound  $\text{Na}_2\text{Mn}_3\text{S}_4$  is produced together with manganese sulphide,  $\text{MnS}$ . Silver nitrate, when mixed with sodium thiosulphate becomes yellow and brown, and on heating nitrous fumes are evolved. The black product contains silver sulphide and the aqueous extract sulphate and sulphide. Cadmium chloride gives a yellow mass which contains cadmium sulphide but not the compound  $\text{NaCdS}$ ; sulphate, sulphide, and chloride are present in the aqueous extract. Sulphur dioxide is evolved from the mixture with zinc oxide, and zinc sulphide is formed; the product is brown but becomes of a yellow colour on cooling. Black metallic lead sulphide is formed by the action of sodium thiosulphate on lead chloride.

When a mixture of five parts of sodium thiosulphate with one part of sodium chromate is heated, a brownish-red mass is formed which contains sulphate, sulphide, and sodium sulphochromite. When the sulphochromite is ignited, it forms the oxide  $\text{Cr}_2\text{O}_3$ , and when dissolved in aqua regia it is oxidised to sulphochromate. By the action of silver nitrate or salts of lead, copper, or mercury (mercurous) on sodium sulphochromite, the corresponding salt of the metal is formed and the solution becomes green.



Molybdic acid and sodium thiosulphate yield the lustrous black sulphide,  $\text{MoS}_2$ ; when the aqueous extract which contains thiomolybdate is acidified with sulphuric acid and boiled, the reddish-brown sulphide,  $\text{MoS}_3$ , is formed. The mixture obtained by triturating sodium thiosulphate with tungsten trioxide is greenish-yellow and on ignition yields the sulphide  $\text{WS}_2$ ; when the aqueous solution is acidified with hydrochloric acid and boiled, yellow tungstic acid,  $\text{WO}_3 \cdot \text{H}_2\text{O}$ , is precipitated.

When stannous chloride and sodium thiosulphate are rubbed together the mixture becomes bright brown and stannous sulphide is formed on ignition. Tin foil combines energetically with the sulphur of sodium thiosulphate, and arsenious and arsenic oxides yield the red disulphide and the yellow trisulphide respectively. Antimony oxide forms brown, greyish-black antimony sulphide,  $\text{Sb}_2\text{S}_3$ .

Sodium iron sulphide,  $\text{Na}_2\text{Fe}_2\text{S}_4$ , obtained by heating four parts of sodium thiosulphate with one part of iron, forms dark green, needle-shaped crystals, but loses its crystalline structure on exposure to the air, becoming voluminous and finally forming a brownish-black powder which gives a dark green solution in water and evolves hydrogen sulphide when treated with hydrochloric acid. The same amorphous substance may also be prepared by melting sodium thiosulphate with iron at low temperatures. Sodium iron sulphide is insoluble in water and when heated forms the oxide; by the action of concentrated hydrochloric acid, hydrogen sulphide and sulphur are liberated, and when boiled with solutions of potassium cyanide, potassium ferrocyanide is formed. When anhydrous cobalt chloride is triturated with sodium thiosulphate, it becomes blue and then green and the black compound  $\text{Na}_2\text{Co}_4\text{S}_6$  is formed on ignition. Anhydrous nickel chloride turns brownish-green; sulphur dioxide and sulphur are liberated on heating and the product has a composition corresponding with the formula  $\text{Na}_2\text{Ni}_2\text{S}_3$ . At low temperatures, the product is black and has the empirical composition  $\text{Na}_2\text{Ni}_4\text{S}_{10}$ . Cupric chloride yields sulphur, sulphur dioxide, and black cuprous sulphide, and mercuric chloride, sulphur, sulphur dioxide, and black amorphous sulphide,  $\text{HgS}$ . Cinnabar is converted into the black sulphide when ignited with sodium thiosulphate, and a black sublimate is also formed which becomes red when rubbed. Bismuth chloride forms slender, grey needles of the compound  $\text{Na}_2\text{Bi}_2\text{S}_4$ , and thallium sulphate a brick-red product which is rapidly converted into the brown sulphide,  $\text{Tl}_4\text{S}_5$ , on exposure to air. Sulphide and sulphate are formed by the action of magnesium powder on sodium thiosulphate and bright yellow aluminium sulphide is obtained from alumina.

E. W. W.

**Reduction of Trithionates to Sulphites by Arsenite and Stannite.** AUGUST GUTMANN (*Ber.*, 1905, 38, 3277—3281. Compare this vol., ii, 384).—Sodium trithionate is reduced to sodium sulphite by sodium arsenite in sodium hydroxide solution; the amounts of arsenate and thiarsenate formed agree with those required by the equation  $\text{Na}_2\text{S}_3\text{O}_6 + 2\text{Na}_3\text{AsO}_3 + 2\text{NaOH} = 2\text{Na}_2\text{SO}_3 + \text{Na}_3\text{AsSO}_3 + \text{Na}_3\text{AsO}_4 + \text{H}_2\text{O}$ . Sodium trithionate is reduced by sodium stannite and hydroxide to sodium sulphite, stannate, and thiostannate. Sodium

dithionate is not reduced by sodium arsenite or stannate solution at the laboratory temperature or at the boiling point. G. Y.

**Preparation of Stable, Dry Hyposulphites.** BADISCHE ANILIN- & SODA-FABRIK (D.R.-P. 160529).—Water is readily removed from metallic hyposulphites by means of methyl or ethyl alcohol, acetone, or ethyl acetate. In presence of such liquids, sodium hyposulphite may be heated to  $100^{\circ}$  and the sodium zinc salt still more strongly without decomposition. The solid is made into a paste with one of these liquids, washed, drained, and dried at  $70^{\circ}$ . The washing liquid is dehydrated by means of lime or a similar agent, distilled, and again employed. In the case of the sodium salt, the final product contains 96—98 per cent. of pure hyposulphite. C. H. D.

**Direct Synthesis of Ammonia.** EDGAR P. PERMAN (*Proc. Roy. Soc.*, 1905, *A*, 76, 167—174. Compare *Proc. Roy. Soc.*, 1904, 74, 110; also Hemptinne, *Abstr.*, 1902, ii, 450; Haber and van Oordt, this vol., ii, 159).—Ammonia cannot be synthesised by heat alone, and the decomposition of ammonia by heat may accordingly be regarded as a non-reversible reaction. Ammonia may be synthesised in small quantities, (a) by heating with metals, iron for example; (b) by exploding with oxygen; (c) by sparking. These are reversible reactions. The synthesis of ammonia is apparently affected only when the gases are ionised. Metals which readily form nitrides (magnesium, for example) do not promote the synthesis of ammonia to a greater extent than other metals, hence it appears that the nitrides are not an intermediate stage in the formation of ammonia. J. C. P.

**Formation of Ammonia from its Elements.** FRITZ HABER and G. VAN OORDT (*Zeit. anorg. Chem.*, 1905, 47, 42—44. Compare this vol., ii, 159).—Perman's criticism (*Proc. Roy. Soc.*, 1905, *A*, 76, 169) is shown to be inapplicable to the authors' work. D. H. J.

**Action of Nitrogen on Water-vapour at High Temperatures.** OLIN F. TOWER (*Ber.*, 1905, 38, 2945—2952; *J. Amer. Chem. Soc.*, 1905, 27, 1209—1216).—Nitrogen saturated with water-vapour was passed through a glass globe in which it was subjected to the action of sparks from a large induction coil, and the amount of hydrogen and nitric acid formed was determined.

In a further series of experiments, the nitrogen—water-vapour mixture was passed through an electrically heated Nernst iridium furnace. The gases issuing from the furnace were passed through a tube containing concentrated sulphuric acid, mixed with oxygen to oxidise the nitric oxide, and finally passed through a second sulphuric acid tube. The reaction  $N_2 + 2H_2O \rightleftharpoons 2NO + 2H_2$  was studied in this way at  $2000^{\circ}$ .

The interaction of nitrogen and water-vapour takes place extremely slowly; an equilibrium is reached probably when 4 c.c. of nitric oxide are present per litre, whilst the amount calculated from the dissociation of water-vapour and the equilibrium between nitrogen, oxygen, and nitric oxide is 3.3 c.c. G. Y.

**Constitution of Nitric Acid and its Hydrates.** W. NOEL HARTLEY (*Proc. Roy. Dublin Soc.*, 1905, [ii], 10, 373—377).—The author's previous work (*Trans.*, 1903, 85, 658) had indicated the probable existence of the acid  $\text{H}_3\text{NO}_4 \cdot \text{H}_2\text{O}$ , and he now points out the agreement of his results and of those of Velej and Manley (*Abstr.*, 1902, ii, 135) with the demonstration by Erdmann of the existence of orthonitric acid and other polybasic nitric acids (*Abstr.*, 1903, ii, 73).  
L. M. J.

**Explosions of Mixtures of Coal Gas and Air in a Closed Vessel.** LEONARD BAIRSTOW and A. D. ALEXANDER (*Proc. Roy. Soc.*, 1905, A, 76, 340—349).—Mixtures of coal-gas and air are not inflammable until the volume of coal-gas is greater than one-seventeenth of the total volume. Only a small fraction of the gas then burns, but this fraction rapidly increases as the mixture becomes richer, until the coal-gas is one-twelfth of the total volume. The least inflammable of the constituents then burns, and combustion remains complete so long as air is in excess. In the latter cases it is still probable that the constituents burn successively and not simultaneously. The hypothesis of a specific heat increasing with temperature is not supported by direct experiment. The difference between the pressures calculated for explosions in a closed vessel and those actually obtained is probably due to the partial decomposition of both steam and carbon dioxide demonstrated by Deville.  
J. C. P.

**Variations in the Amount of Carbon Dioxide in the Air of Kew during the Years 1898—1901.** HORACE T. BROWN and FERGUSSON ESCOMBE (*Proc. Roy. Soc.*, 1905, B 76, 118—121).—The average of 91 experiments gave 2.94 volumes of carbon dioxide in 10,000 of air, the lowest value being 2.43, and the highest (obtained during a fog) 3.60. The proportion is, as a rule, somewhat greater during the winter than during the summer, but the variations probably depend more on anticyclonic than on seasonal conditions.

Reference is made to the importance of these variations for plant nutrition, since it has been shown that, within fairly wide limits, the rate of assimilation is proportional to the partial pressure of the carbon dioxide.  
G. S.

**Atomic Weight of Silicon.** II. JULIUS MEYER (*Zeit. anorg. Chem.*, 1905, 47, 45—55).—Jordis has privately drawn the author's attention to the fact that the method of determining the atomic weight of silicon employed by the latter, decomposition of silicon tetrachloride with cold water and ignition to silicon dioxide (this vol., ii, 246), might be inaccurate owing to the obstinate retention of a small amount of hydrogen chloride in chemical combination with the silica, even after long ignition (compare Jordis and Kanter, *Abstr.*, 1903, ii, 475). In the present paper, the retention of a small amount of hydrogen chloride by the silica when the ignition is carried out at a low temperature is confirmed; conductivity measurements showed, however, that it is not chemically combined with the silica, as had been supposed, but is retained by absorption. When, on the other hand,



the ignition is carried out at  $1000^{\circ}$  for three or four hours, the amount of hydrogen chloride retained is quite inappreciable. Since the results given in the former paper were obtained by ignition at  $1000^{\circ}$  until the weight was constant (often for five or six hours), the objection does not apply.

Employing the new value for chlorine, 35.47, found by Richards and Wells (this vol., ii, 450), the value  $\text{Si} = 28.25$  ( $\text{O} = 16$ ) is obtained from the results given in the previous paper. G. S.

**Decomposition of Silicon.** THEODOR GROSS (*Chem. Centr.*, 1905, ii, 953; from *Elektrochem. Zeit.*, 12, 48—50).—When an alkaline solution of potassium silicate was electrolysed by means of an alternating current between electrodes of silver containing a small quantity of copper, the evolution of gas ceased after an hour and no further decomposition occurred. The solution was found to have lost up to 20 per cent. of silica. The residue contained a new substance which could not be further decomposed. After fusing with sodium potassium carbonate, a pinkish-white residue remained, the weight of which was equal to about 14 per cent. of the silica which had disappeared. This substance was only partially soluble in hydrofluoric acid, almost insoluble in hydrochloric acid, and quite so in water or nitric acid; when fused with a large quantity of potassium hydroxide, the product was completely soluble in dilute hydrochloric acid. The hydrochloric acid solution gave a precipitate with potassium hydroxide, which was not soluble in excess of the alkali. When silica or flint was dissolved in molten alkali and the solution submitted to the action of an alternating current, a similar substance was obtained. The author concludes that silicon is partially decomposed and supposes that carbon is one of the constituents. E. W. W.

**Preparation of Silicic Acids by the Decomposition of Natural Silicates.** GUSTAV TSCHERMAK (*Zeit. physikal. Chem.*, 1905, 53, 349—367).—Various silicic acids have been obtained by digesting natural silicates with dilute or strong hydrochloric acid for a considerable time at a temperature generally below  $60^{\circ}$ . The product was carefully washed by decantation and then placed in an open dish with sufficient water to cover it. The loss of weight of this dish was determined regularly at intervals of twenty-four hours, and the point at which all mechanically-held water was given off could thus be determined, for the rate at which the chemically combined water is given off is much less. At the point just referred to, the loss on ignition of the silicic acid was determined, and the composition of the latter thus ascertained. By this method, it has been shown that natrolite,  $\text{Si}_5\text{O}_{12}\text{Al}_2\text{Na}_2\text{H}_4$ , diopside,  $\text{SiO}_4\text{CuH}_2$ , and zinc silicate,  $\text{SiO}_5\text{Zn}_3\text{H}_2$ , are derivatives of orthosilicic acid,  $\text{SiO}_4\text{H}_4$ . Anorthite,  $\text{Si}_2\text{O}_8\text{Al}_2\text{Ca}$ , is a derivative of metasilicic acid,  $\text{SiO}_3\text{H}_2$ . Leucite,  $\text{Si}_2\text{O}_6\text{AlK}$ , and serpentine,  $\text{Si}_2\text{O}_9\text{Mg}_3\text{H}_4$ ,

are derivatives of what is termed "leucite" acid,  $\text{Si}_2\text{O}_6\text{H}_4$ . Grossular,  $\text{Si}_3\text{O}_{12}\text{Al}_2\text{Ca}_3$ , epidote,  $\text{Si}_3\text{O}_{13}\text{Al}_3\text{Ca}_2\text{H}$ , zoisite,  $\text{Si}_3\text{O}_{13}\text{Al}_3\text{Ca}_2\text{H}$ , prehnite,  $\text{Si}_3\text{O}_{12}\text{Al}_2\text{Ca}_2\text{H}_2$ , are derivatives of "garnet" acid,  $\text{Si}_3\text{O}_8\text{H}_4$ .

Albite,  $\text{Si}_3\text{O}_8\text{AlNa}$ , is a derivative of "albite" acid,  $\text{Si}_3\text{O}_7\text{H}_9$ . The densities of these five silicic acids are, respectively, 1.576, 1.813, 1.809, 1.910, and 2.043. The various acids behave differently towards methylene-blue, and it is found that the strength of coloration produced diminishes as the number of hydroxyl groups (relatively to silicon) falls off.

J. C. P.

**Determination of the Amounts of Neon and Helium in Atmospheric Air.** Sir WILLIAM RAMSAY (*Proc. Roy. Soc.*, 1905, A, 76, 111—114. Compare Abstr., 1903, ii, 476).—Dewar's method of using cooled cocoanut charcoal as an absorbent for gases has made it easy to carry out the determination, for at  $-100^\circ$  air is readily absorbed by such charcoal, whilst neither helium nor neon is absorbed in appreciable quantity. Further, at the temperature of liquid air, neon is retained by charcoal in considerable quantity, whilst helium is not so retained. Working on the basis of these observations, the author finds that the percentage of neon in gaseous air is 0.0000086 by weight and 0.0000123 by volume, the percentage of helium being 0.00000056 by weight and 0.0000040 by volume. The experiments indicate also that the amount of free hydrogen in air must be less than 1/500th of the volume of neon and helium together.

J. C. P.

**Electric Preparation of Colloidal Metals.** THE SVEDBERG (*Ber.*, 1905, 38, 3616—3620. Compare Bredig, Abstr., 1900, ii, 213; Billitzer, *ibid.*, 1902, ii, 454; Blake, *Amer. J. of Sci.*, 1903, 16, 431).—Colloidal solutions of metals cannot be obtained by Bredig's method when organic solvents are used, as considerable quantities of carbon are always deposited. Blake's method gives negative results with ether, chloroform, benzene, or acetone.

Colloidal solutions of metals in organic solvents have been obtained by suspending the metal in the form of thin foil and using electrodes of iron or aluminium with a potential difference of 110 volts and a current density so small that it can scarcely be measured by an ordinary ammeter. Tin, gold, silver, and lead have been obtained in a colloidal state in various organic solvents, but extremely hard metals such as aluminium cannot be disintegrated by this method.

A second method consists in connecting a glass condenser of 225 sq. cm. surface with the induction coil and attaching the secondary poles to the electrodes, which are immersed in the liquid contained in a porcelain dish. The metal is used in a granular form or as wire clippings. When the current is passed, sparks play between the metal particles, and in the course of a few minutes dark-coloured solutions are obtained. These contain no large particles and hence need not be filtered. Colloidal solutions of magnesium, zinc, aluminium, tin, antimony, iron, nickel, and even alkali metals in ether have been obtained.

The solutions of sodium are violet and those of potassium bluish-violet in colour, and these facts are used to support Elster and Geitel's view that the colorations produced by cathode or Tesla rays on alkali chlorides are due to colloidal solutions of the metal in the alkali chloride.

J. J. S.

**Boiling Points of the Alkali Metals.** OTTO RUFF and OTTO JOHANNSEN (*Ber.*, 1905, 38, 3601—3604. Compare Carnelley and Williams, *Trans.*, 1879, 35, 563; Perman, *Trans.*, 1889, 55, 326).—The authors have determined the boiling points of the alkali metals in a wrought iron distilling apparatus, which, contrary to previous statements, is not attacked. The temperatures were observed by means of a platinum—platino-rhodium thermo-element. The following boiling points under 760 mm. pressure are accurate to within  $\pm 5^\circ$ : caesium,  $670^\circ$ ; rubidium,  $696^\circ$  ( $698.5^\circ$ ); potassium,  $757.5^\circ$  ( $759^\circ$ ); sodium,  $877.5^\circ$  ( $879^\circ$ ). The temperatures in brackets are the highest observed on rapid boiling of the metals.

Lithium was prepared by electrolytic fusion of a mixture of lithium and potassium chlorides in Muthmann, Hofer, and Weiss' apparatus (*Abstr.*, 1902, ii, 262), the current density being about 85 amperes with an *E.M.F.* of 20 volts. At about  $1400^\circ$ , half of the lithium in the distillation apparatus remained unchanged, the rest being converted into hydride or nitride, and complete volatilisation did not take place even at the melting point of the wrought iron vessel. The boiling point of lithium must be above  $1400^\circ$ .

A curve drawn with the atomic weights of these metals as abscissæ, and their boiling points as ordinates resembles the melting-point curve but does not permit of the boiling points being represented as a simple function of the atomic weights. G. Y.

**Some Reactions of the Alkali and Alkaline-earth Hydrides. Influence of Traces of Moisture on the Decomposition of the Alkali Hydrides by Carbon Dioxide or Acetylene.** HENRI MOISSAN (*Ann. Chim. Phys.*, 1905, [viii], 6, 289—322, 323—333).—A résumé of work already published (compare *Abstr.*, 1902, i, 253, 255; ii, 136, 206; 1903, i, 595, 785; ii, 349, 365, 367; this vol., i, 507). M. A. W.

**Potassium Percarbonate.** WILLIAM D. BROWN (*J. Amer. Chem. Soc.*, 1905, 27, 1222—1224).—The degree of purity of specimens of potassium percarbonate (Constam and Hansen, *Abstr.*, 1897, ii, 550) can be determined by titration with potassium permanganate in a solution acidified with sulphuric acid, when the following reaction takes place:  $5K_2C_2O_6 + 8H_2SO_4 + 2KMnO_4 = 2MnSO_4 + 6K_2SO_4 + 8H_2O + 10CO_2 + 5O_2$ .

Samples of the salt were prepared and found to contain only 30—40 per cent. of the percarbonate, whereas Hansen (*Abstr.*, 1898, ii, 23) obtained a product containing 80—95 per cent. A comparison of the reactions of potassium percarbonate with those of sodium peroxide shows that the latter is to be preferred as an oxidising agent.

E. G.

**Potassium Chromates.** FRANS A. H. SCHREINEMAKERS (*Chem. Centr.*, 1905, ii, 1067; from *Chem. Weekblad*, 1, 837—848. Compare Jaeger and Krüss, *Abstr.*, 1889, 1117).—Potassium trichromate,  $K_2Cr_3O_{10}$ , and potassium tetrachromate,  $K_2Cr_4O_{13}$ , may be prepared by adding chromic acid to the chromate or dichromate. The conditions



of equilibrium of the system—potassium oxide, water, and chromic acid at  $30^{\circ}$  have been investigated. The compounds which separate in a solid form correspond with those obtained in the case of ammonium chromates (this vol., ii, 820), except that when no chromic acid is present the hydrate  $\text{KOH} \cdot 2\text{H}_2\text{O}$  is deposited from a solution which contains about 55 per cent. of potassium hydroxide and 45 of water. At  $30^{\circ}$ , 100 grams of water dissolve 64.91 of potassium chromate and 18.12 of dichromate; it is impossible, therefore, to precipitate the chromate from a solution of dichromate by the addition of a base, but the corresponding dichromate may be precipitated from a solution of potassium or ammonium chromate by the addition of chromic acid. A chromate containing more potassium than potassium chromate cannot exist at  $30^{\circ}$ , and the conditions under which the trichromate is stable are rather limited. A higher chromate than the tetrachromate does not exist at  $30^{\circ}$  in conjunction with its saturated solution. Potassium tri- and tetra-chromates are decomposed by water, forming dichromate.

E. W. W.

**Electrolytic Preparation of Sodium.** KONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE (D.R.-P. 160540).—In the electrolysis of fused sodium chloride, a considerable quantity of metallic sodium dissolves in the bath, and at the high temperature required for fusion is lost by burning. This is avoided by using as an electrolyte a mixture of sodium chloride with potassium fluoride, the former in large excess. In place of potassium fluoride, a mixture of sodium fluoride and potassium chloride may be added. The temperature of fusion is thus lowered.

C. H. D.

**Physical Properties of Sodium Vapour.** P. V. BEVAN (*Proc. Camb. Phil. Soc.*, 1905, 13, 129—131).—Wood has previously observed that sodium vapour appears to possess considerable cohesion and frequently exhibits a free surface (*Phil. Mag.*, 1904, [vi], 8, 296). The formation of a cloud of sodium vapour is easily observed by heating a piece of sodium in a partially exhausted tube and observing through the tube a Bunsen flame coloured by sodium. The cloud possesses a definite boundary if the pressure of the gas in the tube is sufficiently high, but in a high vacuum no cloud is observed. In perfectly dry hydrogen also no cloud is formed. It was found that distinct distillation of sodium takes place at  $100^{\circ}$ , that is,  $2^{\circ}$  above its melting point.

L. M. J.

**Preparation of Alkali Nitrites.** JACOB GROSSMANN (D.R.-P. 160671).—In the reduction of sodium nitrate by carbon according to the equation  $2\text{NaNO}_3 + 2\text{NaOH} + \text{C} = 2\text{NaNO}_2 + \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$ , nearly one-half of the sodium nitrate is lost by further reduction when the carbon is employed in the amorphous form. When, however, natural graphite is employed in place of coke, and an oxide or hydroxide of an alkaline-earth in place of sodium hydroxide, this loss is avoided, and a lower temperature suffices for the reduction.

C. H. D.

**Ammonium Chromates.** FRANS A. H. SCHREINEMAKERS (*Chem. Centr.*, 1905, ii, 1066—1067; from *Chem. Weekblad*, 1, 395—410. Compare Jaeger and Kriess, *Abstr.*, 1889, 1117).—The conditions of equilibrium of systems consisting of ammonia, chromic acid, and water at 30° have been investigated. The following compounds separate in the solid state in the order given: ammonium chromate and dichromate, dichromate, dichromate and trichromate, trichromate, trichromate and tetrachromate, tetrachromate and chromic acid, chromic acid. Ammonium chromate cannot be dried at 100° without decomposing, and even at lower temperatures it gives off ammonia and forms dichromate. The chromate and dichromate are not decomposed by dissolving in water, but the tri- and tetra-chromates are. Chromates containing more ammonia than ammonium chromate are not formed even at 0°; the chromate is the only compound which separates in a solid form at 0° from solutions containing about 1.5 per cent. of chromic acid and about 42 of ammonia. At 30°, 100 grams of water dissolve 47.17 of dichromate, about 40.4 of chromate, and 165.1 of chromic acid. The whole series of chromates may be prepared by adding chromic acid to the chromate. E. W. W.

**Reaction between Silver Nitrate and Disodium Hydrogen Phosphate.** YUKICHI OSAKA (*Mem. Coll. Sci. Eng. Kyōto*, 1904—5, 1, 158—167. Compare Berthelot, *Abstr.*, 1901, ii, 503).—The influence of the concentration and of the relative proportions in the reaction between silver nitrate and disodium hydrogen phosphate at 25° has been studied. When the two substances are mixed in equivalent proportions, the percentage of the silver precipitate increases slightly with the concentration. Within the limits represented by 0.005 and 0.120 mol.  $\text{AgNO}_3$  per litre, the percentages are 51.8 and 59.0 respectively. Solubility experiments indicate that the concentration of the silver remaining in the solution is the same as that in a saturated solution of nitric acid of which the concentration is equal to the concentration of the acidic hydrogen in the former. The following solubility data were obtained.

Concentration of nitric acid.								Mols. per litre
0.005	0.01	0.015	0.02	0.025	0.03	0.035	0.04	
Concentration of silver in solution.								Mols. per litre
0.00748	0.0142	0.0206	0.0263	0.0325	0.0387	0.0434	0.0494	

Assuming that the solutions contain principally silver nitrate, silver dihydrogen phosphate, and free phosphoric acid together with their dissociation products, the equilibrium condition has been deduced and this is shown to be satisfied by the experimental data for varying dilution and varying relative proportion of the reacting substances. The influence of an excess of silver nitrate in increasing the amount of precipitated silver phosphate is small, and this increase is very nearly proportional to the excess of silver nitrate added. On the other hand, the influence of an excess of disodium hydrogen phosphate is very considerable and the precipitation of the silver is practically complete when three equivalents of disodium hydrogen

phosphate are added to one equivalent of silver nitrate. This result also agrees with the theoretical relationship deduced. H. M. D.

**Equilibrium among Certain Bases in Simultaneous Contact with Phosphoric Acid.** ANTONIO QUARTAROLI (*Gazzetta*, 1905, 35, ii, 290—304).—On saturating one mol. of phosphoric acid with an equivalent of lime (or baryta) and two equivalents of sodium (or potassium) hydroxide, precipitation of two-thirds of the phosphoric acid with formation of the double salt,  $\text{Ca}_2\text{Na}_6(\text{PO}_4)_4$  or  $\text{Ba}_2\text{Na}_6(\text{PO}_4)_4$  [which Berthelot (*Abstr.*, 1901, ii, 504) stated to occur] does not take place, scarcely one-third of the phosphoric acid being precipitated in the form of tri- and tetra-basic phosphates. Two-thirds of the phosphoric acid remains in solution as tri- and di-basic phosphates. Hence, bases added in equivalent quantities to phosphoric acid distribute themselves unequally between the solution and the precipitate, and, as the latter is partly composed of tetrabasic phosphates, the solution must contain a certain amount of dibasic phosphates. An exception to this is met with when a solution of phosphoric acid containing one equivalent of baryta and two equivalents of sodium hydroxide is left for a long time; one atom of sodium and one of barium (less than was calculated by Berthelot) then pass into the insoluble condition and precipitate a little less than half of the phosphoric acid.

Nor when one mol. of phosphoric acid is saturated with one equivalent each of lime (or baryta) and sodium (or potassium) hydroxide is it found that two-thirds of the phosphoric acid is precipitated with formation of insoluble double phosphates containing equivalent quantities of calcium and sodium. In this case, too, the bases are unequally distributed between the precipitate and the solution, the latter containing mono- and di-basic phosphates and the former di- and tri-basic, and in some cases tetra-basic phosphates.

Magnesia exhibits a behaviour which is different from that of lime or baryta and which varies markedly with the alkali present. Thus, on adding one equivalent of magnesia and two equivalents of sodium hydroxide to one mol. of phosphoric acid, only magnesium is precipitated, whilst if the sodium hydroxide is replaced by potassium hydroxide, a portion of the latter passes into the insoluble state. On adding one equivalent of sodium or potassium hydroxide to monomagnesium phosphate, the amount of phosphoric acid precipitated is much less than in the other cases and only amounts to about one-sixth of the total quantity; seeing that dimagnesium phosphate, like the dicalcium salt, is only very slightly soluble and that the alkali hydroxide present is sufficient to precipitate it, it is probable that soluble double phosphates are formed. T. H. P.

**Solubility of Barium Sulphite in Water and in [Sucrose] Solutions.** JOHANN ROGOWICZ (*Zeit. Ver. Deut. Zucker-Ind.*, 1905, 596, 938—940).—The results of the author's measurements, in grams of barium sulphite present in 100 c.c. of solution, are given in the following table:



	20°.	80°.
Water.....	0·01974	0·00177
Sucrose solution, 10° Brix .....	0·01040	0·00335
"      "      20      "      .....	0·00968	0·00289
"      "      30      "      .....	0·00782	0·00223
"      "      40      "      .....	0·00484	0·00158
"      "      50      "      .....	0·00298	0·00149
"      "      66      "      (saturated) ...	0·00223	0 00112

T. H. P.

**The Molecular Weight of Mercuric Silver Iodide.** WALTER HERZ and M. KNOCH (*Zeit. anorg. Chem.*, 1905, **46**, 460).—The molecular weight of the double iodide has been determined in alcoholic solution by the boiling-point method and found = 428. The theoretical value for  $\text{HgI}_2 = 453\cdot9$ . Hence the salt is undissociated and unimolecular in alcoholic solution.

D. H. J.

**Manganese-Iron Alloys.** MAX LEVIN and GUSTAV TAMMANN (*Zeit. anorg. Chem.*, 1905, **47**, 136—144).—The freezing-point curve indicates the absence of any compound of iron and manganese; there exists an unbroken series of mixed crystals of the two metals. This result is only apparently opposed to the microscopic appearance of the alloys; under the microscope, there appear to be in some cases two structural elements, but this is due to the fact that during rapid cooling equilibrium is not at once established between the liquid alloy and the mixed crystals, and crystals richer in iron separate first and then become surrounded by others, richer in manganese. The melting point of manganese is  $1247^\circ$ , of iron  $1551^\circ$ . Preliminary experiments to ascertain the temperatures at which the magnetic permeability of manganese-iron alloys abruptly change, gave the following results:

Percentage of iron .....	100	90	80
Disappearance .....	$950^\circ$	$820^\circ$	$750^\circ$
Return .....	$750^\circ$	$715^\circ$	$720^\circ$

D. H. J.

**Reduction of Oxides, a New Method of preparing the Binary Compound,  $\text{SiMn}_2$ , by means of Aluminium.** ÉMILE VIGOUROUX (*Compt. rend.*, 1905, **141**, 722—724. Compare Abstr., 1896, ii, 362).—By firing a mixture of silica, manganese oxide, and aluminium, and allowing the flux to cool very slowly, a brittle mass is obtained which, after extraction with dilute hydrochloric acid and then with dilute hydrofluoric acid, consists of crystals of the manganese silicide,  $\text{SiMn}_2$ , which is decomposed by the action of warm hydrochloric or nitric acid, and in this respect differs from the compound of the same composition described by Lebeau (compare Abstr., 1903, ii, 215). Attempts to prepare a silicide containing a higher proportion of manganese than the one described above were not successful.

M. A. W.

**Conditions of Stability of Certain Suspensions.** FEDERICO GIOLITTI (*Gazzetta*, 1905, 35, ii, 181—192).—The author has made a number of experiments on the coagulation of colloidal ferric hydroxide solution, prepared by boiling freshly-prepared ferric acetate solution until acid vapours are no longer evolved. A gelatinous hydrogel is formed by the addition to this solution of a small quantity of sulphuric, sulphurous, selenious, iodic, periodic, boric, or phosphoric acid, or of certain salts. The addition of a small amount of hydrochloric, hydrobromic, hydriodic, nitric, perchloric, or perbromic acid to the colloidal solution causes slight precipitation of a finely-divided, brick-red powder which cannot be removed by filtration, is soluble in water, and is obtained in larger quantity if the amount of acid added is increased. The acids given in the first of the above two groups all act with about equal rapidity, even when present in only very small amounts. With those of the second group, it is possible to state limits of concentration between which they are capable of completely precipitating the ferric hydroxide; in this case, too, the precipitate obtained has all the properties of the hydrogel, whilst the acids of the first group yield a precipitate with altered properties.

A solution of ferric hydroxide produced by the dialysis of a solution of ferric chloride saturated with freshly-precipitated ferric hydroxide exhibits less regularity in its behaviour, the amount of the precipitate, for example, increasing gradually with the amount of acid added.

Other colloidal solutions exhibit properties similar to those observed with ferric hydroxide solution.

T. H. P.

**Constitution and Genesis of Iron Sulphates: Synthesis of Sodium Ferric Sulphates.** RUDOLF SCHARIZER (*Zeit. Kryst. Min.*, 1905, 41, 209—225).—The greenish-white ferrinatrite (=ferro-natrite),  $\text{Na}_6\text{Fe}_2\text{S}_6\text{O}_{24}\cdot 6\text{H}_2\text{O}$ , and the orange-yellow sideronatrite,  $\text{Na}_4\text{Fe}_2\text{S}_4\text{O}_{17}\cdot 7\text{H}_2\text{O}$ , both of which are from Chili, are considered to be derivatives of the acid ferric sulphate,  $\text{Fe}_2(\text{OH})_2(\text{SO}_4)_4\cdot 6\text{H}_2\text{O}$ , and to have the constitutional formulæ  $\text{Fe}_2(\text{SO}_4\text{Na})_6\cdot 6\text{H}_2\text{O}$  and  $\text{Fe}_2(\text{OH})_2(\text{SO}_4\text{Na})_4\cdot 6\text{H}_2\text{O}$  respectively.

Ferrinatrite is obtained artificially by allowing a mixture of acid ferric sulphate and acid sodium sulphate to remain in a moist atmosphere for several months. The greenish-white crystallised product is hexagonal, and has the composition given above; it loses all its water at  $100^\circ$ .

Sideronatrite is obtained as indistinct (orthorhombic?) crystals by the slow evaporation of a solution containing ferric and sodium sulphates and sulphuric acid, but if allowed to remain in contact with the solution it soon changes to ferrinatrite. It is also deposited from a solution of ferrinatrite, or when a solution of acid sodium sulphate acts on ferric hydroxide. Six-sevenths of the water of artificial sideronatrite is lost at  $125^\circ$ , the remaining molecule being expelled only at a high temperature.

L. J. S.

**Higher Oxide of Nickel.** ITALO BELLUCCI and E. CLAVARI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 234—242).—Experiments on the oxidation of nickel sulphate in alkaline solution by means of various

oxidising agents and under various conditions of temperature and dilution lead to the following conclusions: (1) Any one oxidising agent yields, both at the ordinary temperature and on heating, products giving the same value for the ratio nickel:oxygen, but at  $0^\circ$  the proportion of oxygen is much higher. (2) The degree of oxidation of the nickel depends on the nature of the oxidising agent and on the rapidity of the oxidation, the lowest numbers being obtained when the precipitate is left for a long time in contact with excess of the oxidising solution. (3) None of the oxidising agents employed led to the formation of an oxide having the formula  $\text{Ni}_2\text{O}_3$ . (4) On oxidation with bromine in presence of excess of potassium carbonate at  $0^\circ$  and washing the precipitate with concentrated potassium carbonate solution, the ratio of nickel to oxygen was found to have the value 10:19.07; this is in good agreement with the numbers 10:20 required by the oxide  $\text{NiO}_2$ , the existence of which has been assumed by Dufau (Abstr., 1897, ii, 200). This oxide readily loses oxygen, forming substances which vary in composition with the conditions, and to which no definite formulæ can be given. (5) When nickel dioxide loses oxygen, no arrest occurs at the stage  $\text{Ni}_2\text{O}_3$ , which may, however, represent a relatively stable compound; on drying over calcium chloride at  $100^\circ$ , it passes always into compounds for which the ratio of Ni:O is in some cases approximately 10:14 and in others 10:13.

Nickel hence behaves differently from cobalt, which forms an oxide,  $\text{Co}_2\text{O}_3$ , capable of being dried at  $100^\circ$  without decomposing. The oxides, which have been described as  $\text{Ni}_2\text{O}_3$  and  $\text{Ni}_3\text{O}_4$ , must be regarded as mixtures of  $\text{NiO}_2$  and  $\text{NiO}$ . T. H. P.

**Perchromic Acids.** E. H. RIESENFELD [with KUTSCH, OHL, and WOHLERS] (*Ber.*, 1905, 38, 3380—3384. Compare this vol., ii, 461; and Hofmann and Hindlmaier, *ibid.*, 716).—Hydrogen peroxide oxidises alkaline solutions of chromic acid to form reddish-brown salts derived from the acid  $\text{H}_3\text{CrO}_8$ . If, however, the solution is acidified with almost any acid (hydrochloric, oxalic, or acetic) before the peroxide is added, crystalline, blue salts derived from the acid  $\text{H}_3\text{CrO}_7$  are formed (compare Wiede, Abstr., 1898, ii, 28, 295). On adding hydrogen peroxide to an aqueous solution of chromic acid containing excess of pyridine, a blue pyridine salt,  $\text{PyHCrO}_5$ , derived from the acid  $\text{HCrO}_5$ , is obtained. Yellow crystals of the composition  $\text{CrO}_4 \cdot 3\text{NH}_3$  are formed when the solution used in preparing the salt  $(\text{NH}_4)_3\text{CrO}_8$  (*loc. cit.*) is kept for twenty-four hours.

The salts of the acids named can be converted into one another. On adding an acid to an aqueous suspension of the salt  $(\text{NH}_4)_3\text{CrO}_8$ , oxygen is evolved and the blue substance  $(\text{NH}_4)\text{H}_2\text{CrO}_7$  produced. On adding an excess of pyridine to either of these salts, the compound  $\text{PyHCrO}_5$  is formed. Finally, from any of the preceding substances the compound  $\text{CrO}_4 \cdot 3\text{NH}_3$  is obtained by the action in aqueous solution of an excess of ammonia.

A brief discussion is given of the nature of these substances and the manner of their formation. Names will be given to them only after a more complete investigation has been made. W. A. D.



**Decomposition of Chromic Acid by means of Hydrogen Peroxide.** E. H. RIESENFELD [with KUTSCH and OHL] (*Ber.*, 1905, 38, 3578—3586. Compare Berthelot, *Abstr.*, 1889, 350, 468, 571; Baumann, *Abstr.*, 1891, 245; Bach, *Abstr.*, 1902, ii, 251).—If hydrogen peroxide is dropped into a mixture of 0.1*N* potassium dichromate solution and 10 per cent. sulphuric acid, the chromic acid being always in excess and the temperature remaining constant at 13.52—18.26°, the amount of oxygen evolved is slightly less (2.89 instead of 3) than that required by the equation  $2\text{CrO}_3 + 3\text{H}_2\text{O}_2 = \text{Cr}_2\text{O}_3 + 3\text{H}_2\text{O} + 3\text{O}_2$ , whilst if the chromic acid solution is dropped into the hydrogen peroxide, the latter being always in excess, a blue coloration is formed which gradually disappears, and the volume of oxygen liberated is equivalent to 4.14—4.97; average, 4.51 mols. of oxygen for each mol. of chromic acid. The reaction takes place, therefore, mainly according to the equations:  $2\text{H}_2\text{CrO}_4 + 7\text{H}_2\text{O}_2 = 2\text{H}_3\text{CrO}_8 + 6\text{H}_2\text{O}$ ;  $2\text{H}_3\text{CrO}_8 = \text{Cr}_2\text{O}_3 + 3\text{H}_2\text{O} + 5\text{O}_2$ , the evolution of a slightly less amount of oxygen than required by these equations being due to formation of a small amount of the perchromic acid,  $\text{H}_3\text{CrO}_7$ . The blue coloration in ethereal solution is formed by the perchromic acids,  $\text{H}_3\text{CrO}_8$  and  $\text{H}_3\text{CrO}_7$ , as well as by the anhydride,  $\text{CrO}_4$ . The decomposition of perchromic acid,  $\text{H}_3\text{CrO}_8$ , is not affected by the presence of hydrogen peroxide, as the amount of oxygen evolved is the same if the decomposition takes place in acid solution or in acid solution with addition of a limited amount of 3 per cent. or 30 per cent. hydrogen peroxide.

If in the oxidation of alkaline chromate solutions by means of hydrogen peroxide the solution is allowed to become warm, the perchromate formed does not separate, but decomposes into chromate and oxygen, the oxidation and decomposition taking place successively until the hydrogen peroxide is completely reduced, the chromate acting as a catalytic agent, as observed by Berthelot. G. Y.

**Molybdates.** ADOLF JUNIUS (*Zeit. anorg. Chem.*, 1905, 46, 428—448).—*Thallium paramolybdate*,  $5\text{Tl}_2\text{O} \cdot 12\text{MoO}_3$ , is obtained by double decomposition from a hot solution of the sodium salt as a yellow, microcrystalline precipitate very easily soluble in alkali hydroxides and carbonates and in mineral acids. When heated, it becomes dark yellow, at a red heat it melts to a dark brown liquid, and finally decomposes with slight volatilisation.

Barium paramolybdate is obtained by double decomposition as a precipitate which dissolves again in excess of barium chloride. From the solution, a bulky precipitate separates after some time, of the formula  $5\text{BaO} \cdot 12\text{MoO}_3 \cdot 20\text{H}_2\text{O}$ . When boiling solutions of the molybdate and chloride are employed, a salt with  $10\text{H}_2\text{O}$  is obtained.

It was not found possible to prepare lead, cadmium, or silver paramolybdates, the normal salt being obtained in each case.

Electrolysis of sodium, potassium, and ammonium molybdates leads eventually (when a diaphragm is employed) to the production of free molybdic acid; limited electrolytic action gives intermediate products.

Sodium molybdate with a current of 6.7 amperes per sq. cm. at 7 to

10 volts gives, after electrolysis for about an hour, a faintly alkaline anodic solution from which the salt  $5\text{Na}_2\text{O}, 12\text{MoO}_3, 36\text{H}_2\text{O}$  may be crystallised. Long-continued electrolysis gives an acid anodic solution from which alcohol deposits crystals of  $\text{Na}_2\text{O}, 3\text{MoO}_3$  with 9 or  $11\text{H}_2\text{O}$ .

Potassium molybdate gives, similarly, the salt  $5\text{K}_2\text{O}, 12\text{MoO}_3, 8\text{H}_2\text{O}$  after a short interval, and later  $\text{K}_2\text{O}, 3\text{MoO}_3, 2\text{H}_2\text{O}$ ; potassium trimolybdate, unlike the sodium salt, does not effloresce.

Ammonium molybdate yields, on electrolysis, the paramolybdate or  $5(\text{NH}_4)_2\text{O}, 12\text{MoO}_3, 7\text{H}_2\text{O}$  or  $(\text{NH}_4)_2\text{O}, 4\text{MoO}_3, 2\frac{1}{2}\text{H}_2\text{O}$  or molybdic acid according to the conditions; the second of these compounds (the tetra- or meta-molybdate) may also be obtained by the addition of hydrochloric acid to a solution of ordinary ammonium molybdate until the liquid reddens methyl-orange, and crystallisation. Similarly, as was confirmed by measurements of the electrical conductivity, sodium paramolybdate may be transformed into the tetra-salt according to the equation  $2\text{Na}_{10}\text{Mo}_{12}\text{O}_{41} + 8\text{HCl} = 6\text{Na}_2\text{Mo}_4\text{O}_{13} + 8\text{NaCl} + 4\text{H}_2\text{O}$ . Electrolytic reduction of molybdic acid in strong hydrochloric acid solution gives at the cathode a precipitate of the blue oxide, to which the formula  $\text{Mo}_7\text{O}_{20}$  is ascribed instead of the  $\text{Mo}_5\text{O}_{14}$  of Berzelius or the  $\text{Mo}_3\text{O}_8$  of Muthmann.

D. H. J.

**Solid Solutions of Indifferent Gases in Uranium Oxide. II.** VOLKMAR KOHLSCHÜTTER and K. VOGDT (*Ber.*, 1905, 38, 2992—3002. Compare this vol., ii, 394).—In reply to Friedheim (this vol., ii, 530), details are given of quantitative experiments which support the authors' views as to the reaction which takes place when hydroxylamine uranate is heated and the nature of the residue.

G. Y.

**Double Carbonate of Uranyl and Ammonium.** FEDERICO GIOLITTI and V. VECCHIARELLI (*Gazzetta*, 1905, 35, ii, 170—181).—On mixing a concentrated solution of ammonium carbonate (5 mols.) with one of uranyl nitrate (2 mols.) at  $50$ — $55^\circ$ , the liquid deposits, on cooling, a bright yellow, crystalline mass of the soluble double salt,  $2\text{UO}_2\text{CO}_3, 3(\text{NH}_4)_2\text{CO}_3, 4\text{H}_2\text{O}$ , which is probably identical with the salt obtained by Plate (Gmelin-Kraut, *Handbuch anorg. Chem.*, 2nd ed., 2, 411); the addition of alcohol to the mother-liquor causes the deposition of a bright yellow powder, which is soluble in water and in which the ratio of  $\text{NH}_3$  : U has the value 9 : 4.

A solution containing excess of ammonia, together with uranyl nitrate (1 mol.) and ammonium carbonate (3 mols.), deposits the double salt,  $\text{UO}_2\text{CO}_3, 2(\text{NH}_4)_2\text{CO}_3$ , in the form of yellow crystals, which lose ammonia at the ordinary temperature and more readily on heating, either in the dry state or in solution; the ratio between  $\text{NH}_3$  and  $\text{CO}_2$  always remains, however, the same, that is, 4 : 3, so that it must be assumed that the salt splits up completely into the two parts  $\text{UO}_2\text{O}$  and  $\text{CO}_2, 2(\text{NH}_4)_2\text{CO}_3$ . The formation of complex ions with this double salt is confirmed by cryoscopic measurements, which indicate an increasing and ultimately almost complete electrolytic dissociation.

T. H. P.

**Equilibrium Phenomena with the Hydrates of Uranous Sulphate. I. Properties of Uranous Sulphate.** FEDERICO GIOLITTI and G. BUCCI (*Gazzetta*, 1905, 35, ii, 151—161).—By the interaction of varying quantities of uranyl sulphate, alcohol, water, and sulphuric acid, the authors have prepared the following hydrates of uranous sulphate: (1)  $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$ , which forms small, dark green crystals and, when treated with a large quantity of cold water, is mostly dissolved, whilst about 25 per cent. of it is converted into a green, powdery basic salt,  $\text{UOSO}_4 \cdot 2\text{H}_2\text{O}$ ; the extent of the hydrolysis effected by water depends on the temperature. If the salt is acted on by a small proportion of water, the basic salt at first separated gradually dissolves and a solution of the normal sulphate is obtained. Ten per cent. sulphuric acid solution dissolves the octahydrate without hydrolysing it. When heated in absence of air, it passes into the tetrahydrate at about  $90^\circ$ , into the anhydrous salt at about  $300^\circ$ , and when ignited, firstly into  $\text{UO}_2\text{SO}_4$ , and finally into  $\text{U}_3\text{O}_8$ . Graphic representation of the rate of loss of water by the octahydrate when kept in a desiccator over sulphuric acid indicates the existence of the hydrates:  $\text{U}(\text{SO}_4)_2 \cdot 7\text{H}_2\text{O}$ ,  $\text{U}(\text{SO}_4)_2 \cdot 3\text{H}_2\text{O}$ , and  $\text{U}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ . (2) The tetrahydrate,  $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ , which behaves similarly to the octahydrate on heating and is more readily decomposed than the latter by water.

T. H. P.

**Equilibrium Phenomena with the Hydrates of Uranous Sulphate. II. Octahydrate and Tetrahydrate of Uranous Sulphate.** FEDERICO GIOLITTI and G. BUCCI (*Gazzetta*, 1905, 35, ii, 162—169. Compare preceding abstract).—Microscopical study of the transformation of the octa- into the tetra-hydrate of uranous sulphate shows that this change proceeds at  $68$ — $87^\circ$ , and hence takes place where the octahydrated sulphate is in a condition of metastable equilibrium. Solutions of the octahydrate are relatively very stable between  $18^\circ$  and  $105^\circ$ , so that the separation of the tetrahydrate sometimes occurs only with difficulty; the exact temperature at which the conversion into the lower hydrate takes place has not been determined. A saturated solution of the unchanged octahydrate contains, at  $18^\circ$ , 10.17 per cent., and at  $93^\circ$ , 63.2 per cent. of  $\text{U}(\text{SO}_4)_2$ , whilst that of the tetrahydrate contains, at  $24^\circ$ , 9.8 per cent., at  $37^\circ$ , 8.3 per cent., at  $48.2^\circ$ , 8.1 per cent., and at  $63^\circ$ , 8.3 per cent. of  $\text{U}(\text{SO}_4)_2$ . The results obtained show that, at temperatures below  $18$ — $20^\circ$ , the octahydrate, which, since it has a less solubility than the tetrahydrate, is the stable form in which uranous sulphate crystallises, is labile at any higher temperatures, the stable form then being the tetrahydrate. The pale green powder obtained by the interaction of 42 grams of uranyl sulphate, 168 grams of water, 336 grams of alcohol, and 41 grams of sulphuric acid under the influence of sunlight, has the composition  $\text{U}(\text{SO}_4)_2 \cdot \text{H}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ .

T. H. P.

**Zirconiumsulphuric Acids.** RUDOLF RUER and MAX LEVIN (*Zeit. anorg. Chem.*, 1905, 46, 449—455).—It has already been shown (this vol., ii, 41) that zirconium sulphate is more correctly considered as zirconiumsulphuric acid. It now appears that there exists another, probably a series of these zirconiumsulphuric acids containing more



zirconium than the normal sulphate and yielding on electrolytic dissociation complex anions containing both zirconium and the sulphate group. The so-called basic zirconium sulphate obtained by dissolving zirconium hydroxide in a solution of neutral zirconium sulphate at  $100^{\circ}$ , seems in reality to be a solution of zirconiumsulphuric acids, to which the formula  $(\text{ZrO}_2)_n(\text{SO}_3)_m(\text{H}_2\text{O})_p$ , where  $n > m/2$ , must be assigned.

The tendency of zirconium to form zirconiumsulphuric acids, richer in metal than the normal salt, explains the difference which a solution of normal zirconium sulphate shows, according to whether it has been prepared in the cold or by boiling; in the heated solution there is formed a zirconiumsulphuric acid, and free sulphuric acid; the latter, as proved experimentally, increasing the electrical conductivity.

D. H. J.

**Bismuth Telluride.** K. MÖNKEMEYER (*Zeit. anorg. Chem.*, 1905, 46, 415—422).—A fusion diagram for bismuth and tellurium has been constructed by Tammann's method, and it has thus been found that there is only one definite compound formed, namely,  $\text{Bi}_2\text{Te}_3$ . The curve of fusion shows a maximum point (corresponding with the compound mentioned) at  $573^{\circ}$  and 52.14 per cent. of bismuth, and two eutectic points at  $261^{\circ}$  and 99.08 per cent. of bismuth and at  $388^{\circ}$  and 13.91 per cent. of bismuth respectively.

D. H. J.

**Columbium and Tantalum.** EDGAR F. SMITH [with ROY D. HALL, MARY E. PENNINGTON, and C. W. BALKE] (*Chem. Centr.*, 1905, ii, 1160—1161; from *Proc. Amer. Phil. Soc.*, 44, 151—158. Compare Abstr., 1904, ii, 824).—Although Marignac found titanium in columbium, the oxide of the latter prepared from potassium columbofluoride has not been found to give the characteristic tests for titanium with hydrogen peroxide and chromotropic acid. Attempts to separate titanium chloride from the crystalline chloride, prepared by means of sulphur monochloride, also failed. Potassium tantalofluoride has been isolated under conditions which precluded the possibility of the presence of the titanium double fluoride and double fluorides of tantalum with caesium,  $\text{TaF}_5, \text{CsF}$  and  $\text{TaF}_5, 2\text{CsF}$ , ammonium,  $\text{TaF}_5, 2\text{NH}_4\text{F}$  and  $\text{TaF}_5, 3\text{NH}_4\text{F}$ , rubidium,  $2\text{TaF}_5, \text{RbF}$ , potassium,  $\text{TaF}_5, 2\text{KF}$ , and sodium,  $\text{TaF}_5, 2\text{NaF}$  and  $\text{TaF}_5, 3\text{NaF}$ , have been obtained. Marignac's atomic weight determinations were very possibly rendered inaccurate by the presence of one of these ammonium compounds in the double fluorides of potassium and ammonium which he employed; moreover, the substance which he regarded as potassium titanofluoride has been found in the columbium and not in the tantalum fraction, and is not sparingly soluble. Attempts to separate this substance, however, by fractional precipitation with aqueous solutions of ammonia, fractional crystallisation of the double fluorides, fractional chlorination of the oxides in presence of carbon, or by the action of numerous organic bases, have failed.

Hermann's statement that the acid mother liquor obtained by repeatedly crystallising potassium columboxyfluoride from water and dilute hydrofluoric acid yields a slimy substance which, when treated with sodium ammonium hydrogen phosphate before the blow-

pipe, forms a yellow mass, has been confirmed, but this substance, which was supposed to be sodium neptunate, has been found to consist of a mixture of tantalum and iron together with some columbium. The removal of tungsten and tin from the oxides of columbium and tantalum can be effected with slight loss by repeated fusion with sodium carbonate and sulphur, but not by the ammonium sulphide method. Complex compounds of tantalum and columbium oxides with tungstic acid have also been prepared.

E. W. W.

**Columbium.** ROY D. HALL and EDGAR F. SMITH (*Chem. Centr.*, 1905, ii, 1161—1163; from *Proc. Amer. Phil. Soc.*, 44, 177—212).—A sample of columbite from Lawrence County, South Dakota, had a sp. gr. 5.86 and contained 81 per cent. of the oxides of columbium and tantalum; iron, manganese, zinc, uranium, copper (?), and nickel (?), together with acids of tantalum, columbium, titanium, lithium, zirconium, tin, and tungsten, were also present. The mother liquors of the potassium tantalofluoride obtained in the method of treatment employed yielded hard, hexagonal crystals of potassium columbofluoride,  $K_2CbF_7$ , and by evaporating the former with sulphuric acid and precipitating with potassium hydroxide, potassium tantaloxyluoride was obtained. Potassium columboxyluoride,  $K_2CbOF_5 \cdot H_2O$ , from which the tantalum had been removed by means of sulphuric acid, was soluble. The oxide formed by the ignition of the columbium double fluoride, when tested by the colorimetric method, was found to contain 0.18 per cent. of titanium oxide.

The following methods were employed for the separation of titanium oxide from columbium oxide. (1) Crystallisation of potassium columbofluoride; this method failed to effect a separation, since the presence of hydrofluoric acid increased the solubility of the columbium and decreased that of the titanium compound. (2) Fractional precipitation with ammonia; columbium hydroxide is first precipitated, but no fraction was found to consist entirely of titanium hydroxide, and the last contained a considerable quantity of columbium. (3) Preparation of the chlorides and oxychlorides of columbium and the chloride of tantalum and separation of the latter by distillation. (4) Treatment of the hydroxides with rather concentrated cold sulphuric acid; titanium hydroxide is soluble, but columbium hydroxide is not. (5) Action of various bases on the double fluorides. Whilst an excess of sodium hydroxide gives a precipitate with a solution of potassium titanofluoride which is insoluble in water, the precipitate formed by sodium or potassium hydroxide in a solution of potassium columboxyluoride dissolves in a slight excess of the alkali, but separates out again in a crystalline form when a large excess is added; when both metals are present, however, the precipitate also contains both. Potassium hydroxide gives a heavy precipitate with solutions of potassium titanofluoride.

Experiments on the action of seventy-four bases in solutions of potassium titanofluoride and potassium columboxyluoride gave the following results. A portion of the bases completely precipitated titanium but not columbium, the latter being soluble in excess and forming a columbate. Columbium was found in the precipitate, how-

ever, and titanium in the solution, the latter being present possibly in the form of a complex titanocolumbic acid (?). The hydroxides of both metals were precipitated by another portion of the bases, which included quinoline, but titanium hydroxide was only partially soluble in excess of the base. A third portion did not precipitate titanium; columbium was partially precipitated, but carried down some titanium. Other bases did not give precipitates with either metal.

The action of solutions of the double fluorides of columbium, titanium, tantalum, tin, and tungsten in sulphuric acid on codeine, morphine, resorcinol, naphthol, pyrogallol, salicylic acid, cinchonidine, *apomorphine*, *narceine*, *berberine*, and *narcotine* has been examined. Solutions of tin gave no colour reactions. The colorations in other cases were destroyed by dilution, *narceine* and *berberine* being the only alkaloids which gave distinctive colorations. The morphine test for titanium proved trustworthy, but even in this case the presence of less than 0.5 per cent. of titanium oxide in columbium oxide could not be detected. Codeine gave no reaction with columbium and resorcinol, but a slight coloration with tantalum, columbium, or tungsten; the latter, however, afforded a trustworthy test for titanium.

Calcined columbium oxide volatilises in a stream of dry hydrogen chloride, forming a white powder which is insoluble in oxalic acid, but dissolves slowly in boiling sulphuric acid; it has probably the composition  $\text{Cb}_2\text{O}_5, x\text{HCl}$ .

If ammonia is added to solutions of the double fluorides of columbium and titanium and the precipitated hydroxides allowed to remain with a solution of sulphuric acid of sp. gr. 1.145, the titanium precipitate is completely dissolved, whilst the columbium is not attacked; when a mixture of the solutions is used, however, the solution and residue contain both metals.

In estimating titanium by means of chromotropic acid, the presence of free mineral acids should be avoided; the method is not in any way superior to the hydrogen peroxide method.

By the action of carbon tetrachloride on calcined titanium oxide at a red heat, it is slowly but completely converted into the chloride, whilst columbium oxide rapidly forms the oxychloride at a lower temperature. The chloride is quickly formed by heating at 200–225° or by subliming the oxychloride in carbon tetrachloride vapour; calcined tantalum oxide is also rapidly converted into the chloride (compare Delafontaine and Linebarger, *Abstr.*, 1896, ii, 653). If the carbon tetrachloride contains traces of moisture, oxychloride is formed and dissolved in the chloride; on sublimation, the oxychloride remains in the form of a glassy residue. Columbium oxychloride sublimes in closed tubes, forming lustrous, silky needles; the chloride  $\text{CbCl}_5$ , which is obstinately retained by the oxychloride, is best removed by subliming in a stream of chlorine over columbium oxide; when carbon tetrachloride is present, columbium chloride is also formed.

Columbium chloride, prepared by the action of sulphur monochloride on the oxide or by heating the oxide with carbon tetrachloride, forms large, yellow, needle-like crystals; it is readily soluble in carbon tetrachloride or sulphur monochloride, forming yellow and red solutions respectively. When the yellow ethereal solution is evaporated on



the water-bath, a viscid liquid is left and acid fumes are evolved; on calcination, the oxide is formed. By the action of gaseous ammonia on the ethereal solution, ammonium chloride and columbium nitride are formed. The chloride is soluble in chloroform, but on heating the solution a brown powder is formed. When the alcoholic solution of the chloride is warmed and concentrated, vapours are given off which are possibly caused by the formation of ethyl columbate. Aniline and pyridine form additive compounds. Solutions in carbon tetrachloride, which is the best solvent, may be used for the preparation of double chlorides.

Potassium oxyfluoropercolumbate,  $\text{KCbO}_2\text{F}_5 \cdot \text{H}_2\text{O}$ , prepared by the action of a 3 per cent. solution of hydrogen peroxide on potassium columboxyfluoride, forms pale yellow crystals; the colour of the solution in water containing a small quantity of hydrogen peroxide is more intense, and on addition of potassium titanofluoride becomes of a still deeper shade, but it is destroyed by the addition of hydrofluoric acid. Acid molybdenum solutions give a similar coloration, but a quantitative colorimetric estimation showed that columbium was not present. The yellow colour of solutions of columbium in hydrofluoric acid cannot be ascribed to the presence of titanium, which gives a straw-yellow coloration, but is probably caused by the greenish-yellow colour of the columbium itself. The yellow hydroxide,  $\text{Cb}(\text{OH})_6$  or  $\text{Cb}_2\text{O}_5 \cdot \text{H}_2\text{O} \cdot 5\text{H}_2\text{O}$ , is prepared by treating the double fluoride with sulphuric acid, expelling the excess of acid, extracting with water, and adding hydrochloric acid and hydrogen peroxide; it loses water and oxygen on calcination and becomes white. The colour of the higher oxides appears to be characteristic of columbium, and not to be due to the presence of titanium. The solubility of potassium titanofluoride is increased by the addition of hydrogen peroxide, whilst that of the corresponding columbium compound is decreased; the presence of hydrofluoric acid has the reverse effect.

Tin and tungsten may probably be separated from potassium columbofluoride by crystallisation from hydrofluoric acid. The presence of tin was shown by the stains formed in the platinum crucible when the partially dried oxide was ignited. If disodium hydrogen phosphate is added to a solution which contains a large excess of columbium and a small quantity of titanium, no precipitate is formed, but on increasing the quantity both metals are completely precipitated. Geisow's observation that titanium and zirconium can be separated from columbium by means of an alkaline solution of formoxime has not been confirmed. Tantalum is only incompletely precipitated. Potassium iodate, which does not contain periodate, does not form precipitates with columbium or titanium, but both metals are precipitated from acid solutions.

E. W. W.

**Columbates.** M. HUME BEDFORD (*J. Amer. Chem. Soc.*, 1905, 27, 1216—1221).—The following sodium columbates have been described by Rose:  $\text{Na}_2\text{O} \cdot \text{Cb}_2\text{O}_5 \cdot 6\text{H}_2\text{O}$  (or  $9\text{H}_2\text{O}$ );  $3\text{Na}_2\text{O} \cdot 2\text{Cb}_2\text{O}_5 \cdot 24\text{H}_2\text{O}$ ;  $3\text{Na}_2\text{O} \cdot \text{Cb}_2\text{O}_5$ ; and  $4\text{Na}_2\text{O} \cdot 5\text{Cb}_2\text{O}_5$ . A fifth salt,  $3\text{Na}_2\text{O} \cdot 4\text{Cb}_2\text{O}_5 \cdot 21\text{H}_2\text{O}$ , has been obtained by Hermann. It is now shown that the methods employed by these authors yield only one sodium columbate, and that

this has the formula  $7\text{Na}_2\text{O}, 6\text{C}_6\text{H}_5\text{O}_5, 32\text{H}_2\text{O}$ . This salt is very stable, and crystallises well from aqueous solutions. The corresponding barium salt,  $7\text{BaO}, 6\text{C}_6\text{H}_5\text{O}_5, 18\text{H}_2\text{O}$ , the silver salt,  $7\text{Ag}_2\text{O}, 6\text{C}_6\text{H}_5\text{O}_5, 5\text{H}_2\text{O}$ , and the zinc salt,  $7\text{ZnO}, 6\text{C}_6\text{H}_5\text{O}_5, 25\text{H}_2\text{O}$ , are described.

The following method is recommended for the separation of columbic and tungstic acids. The solution containing these acids is treated with a solution of mercurous nitrate and a slight excess of nitric acid. Freshly-precipitated mercuric oxide is added, and the mixture is boiled for five minutes. The precipitate is collected, washed, dried, ignited, and weighed. The mixture of the two oxides thus obtained is fused with potassium carbonate, and the product is dissolved in water. An excess of magnesia mixture is added to the solution, and the precipitate produced is left for several hours and then collected, washed five or six times with magnesia mixture, dried, and ignited. The residue is fused with potassium hydrogen sulphate, and the product is boiled with water, filtered, washed, ignited, and the columbic oxide is weighed. The amount of tungstic oxide present in the mixture is obtained by difference.

E. G.

[Platinum Compounds.] ITALO BELLUCCI (*Gazzetta*, 1905, 35, ii, 334—340. Compare Blondel, this vol., ii, 720).—The author dissents from Blondel's deductions (*loc. cit.*), as these he considers are based on purely hypothetical foundations, and are in disaccord with the author's experimental results (compare Bellucci and Parravano, this vol., ii, 395).

T. H. P.

#### Chemical Properties and Combining Weight of Palladium.

RICHARD AMBERG (*Annalen*, 1905, 341, 235—308).—An historical summary of the methods which have been used for quantitative precipitation of palladium and a *résumé* of the different attempts which have been made to determine its atomic weight are given in the introduction.

In the search for suitable compounds of palladium for atomic weight determinations, a number of new additive derivatives with amine bases have been prepared and studied. The compounds with aniline,  $\alpha$ - and  $\beta$ -naphthylamines, diphenylamine, dibenzylamine, *m*-phenylenediamine, benzidine, phenylhydrazine, pyridine, quinoline, acridine, tribenzylamine, and trianilylamine, are described in tabular form. None of them proved suitable for atomic weight determinations, and palladosoammine chloride was finally chosen for this purpose. The salt was prepared in various ways from a specimen of pure palladium (prepared by Siebert).

A number of experiments was made in order to ascertain the most satisfactory method of estimating the palladium in this salt. Finally, the electrical deposition of the palladium was effected in a solution of the salt in dilute sulphuric acid, the operation being carried out in a Classen platinum dish. In the first series of experiments (5 determinations), the chlorine was estimated, the salt being first electrolysed in dilute ammoniacal solution or in acid solution, but the latter was preferred. From the solution freed from precipitated palladium by filtration, the chlorine was precipitated

as silver chloride. In the second series (6 experiments), the chlorine was estimated after precipitation of the palladium with hydrazine sulphate. In the third series (12 experiments), the metal was estimated in solutions containing from 1 to 16 per cent. of sulphuric acid; the electrode was rapidly rotated (from 600—1000 rotations per minute), and the temperature maintained at 60—65°; the current varied from 0.05 to 0.4 ampere, and the voltage was kept below 1.25 volts. The current was maintained whilst the contents of the dish cooled. The palladium was finally collected and dried at 110°. The relation between the precipitation of the metal and the rapidity of rotation of the electrode is discussed. The rapidity of precipitation at the current strength and concentration here used is dependent on the rapidity of stirring, the temperature, and the diffusion-coefficient.

The greatest stress is laid on the direct estimation of the metal by the method just described. The atomic weight of palladium is given as  $106.688 \pm 0.006$  ( $O=16$ ). This extremely high value is not in accord with the differences seen in the series of the periodic system, thus:  $Ru=101.7$ ,  $Rh=103.0$ ,  $Pd=106.7$ ,  $Ag=107.93$ . The old value of the atomic weight of palladium (105.2) shows the differences which would be expected. It is, however, thought, when allowance is made for various possible errors, that the atomic weight is approximately 106.7.

K. J. P. O.

## Mineralogical Chemistry.

**Hydrocarbons in Louisiana Petroleum. II.** CHARLES E. COATES and ALFRED BEST (*J. Amer. Chem. Soc.*, 1905, 27, 1317—1321. Compare Abstr., 1904, ii, 45).—Three further samples of Louisiana petroleum have been examined, but of these only one, which was obtained from Bayou Bouillon, near St. Martinsville, was in sufficient quantity for extended investigation. The results of the examination of this specimen showed that the oil was composed mainly of hydrocarbons of the series  $C_nH_{2n-2}$ , and  $C_nH_{2n-4}$ , and no evidence was obtained of the presence of unsaturated compounds or of optical activity.

E. G.

**Thorianite, a New Mineral from Ceylon.** WYNDHAM R. DUNSTAN and GEORGE S. BLAKE (*Proc. Roy. Soc.*, 1905, A, 76, 253—265. Compare Dunstan, Abstr., 1904, ii, 744).—The crystallographic character of thorianite is described, and the results of analysis of another specimen of the mineral are communicated. The percentages of the various constituents are given as follows:

ThO <sub>2</sub>	UO <sub>2</sub>	UO <sub>3</sub>	CeO <sub>2</sub> , La <sub>2</sub> O <sub>3</sub> and Di <sub>2</sub> O <sub>3</sub>	PbO.	Fe <sub>2</sub> O <sub>3</sub>	CaO.	He.	P <sub>2</sub> O <sub>5</sub>	Insoluble in nitric acid.
78.86	6.03	9.07	1.02	2.59	0.46	1.13	0.39	trace	0.20



Thorianite possesses the advantage, not shared by any known thorium mineral, of containing uncombined thoria, soluble in nitric acid with formation of thorium nitrate. The powdered mineral dissolves readily also in diluted sulphuric acid with evolution of a gas which is chiefly helium. Thorianite is scarcely attacked by hydrochloric acid. The hardness of thorianite is nearly 7, and the density of different specimens varies from 8—9·7.

So far as the investigation has gone it appears probable that thorianite is isomorphous with uraninite, and that in the thorianite of Ceylon some of the thoria is replaced by the corresponding uranium oxide. The evidence, however, is not sufficient to show whether this is a case of isomorphous mixture, as seems probable, or of true chemical replacement.

Thorianite is highly radioactive, and measurements of the rate of decay of the emanation indicate the presence of radium in the mineral (compare also Hahn, this vol., ii, 432, 789). J. C. P.

**Crystallised Slag from Hettstedt: Composition of Melilite.** FERRUCCIO ZAMBONINI (*Zeit. Kryst. Min.*, 1905, 41, 226—234).—Large, cube-shaped crystals, measuring 16 × 19 mm., in a blast-furnace slag from the Seigerhütte at Hettstedt, near Mansfeld, in Prussian Saxony, have been analysed (anal. I) by W. STAHL (*Berg- und Hüttenm. Zeit.*, 1904, 63, 273—274); he described the crystalline form as cubic, and was unable to identify the material. A new examination proves the crystals to be melilite and of the form common in slags. The double refraction is very feeble and negative in sign, but portions of some crystals are isotropic; pleochroism is distinct. The crystals enclose numerous impurities. A redetermination of the silica gave 37·69 per cent.

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.†	35·80	9·34	—	21·50	—	24·50	2·74	0·85	1·36	—	100·71
II.	40·14	6·47	9·95	0·53	trace	32·98	6·33	1·49	2·18	0·27	100·34
III.	39·20	7·56	11·34	trace	trace	32·18	6·41	1·45	2·21	0·21	100·56

† Also: ZnO, 4·00; NiO, 0·19; (Cu<sub>2</sub>,Ni)S, 0·43; Pb, As, traces. Sp. gr. 3·05.

New analyses are given of the natural melilite of Capo di Bove, near Rome; II, of yellow crystals, and III, of brown crystals.

From Damour's analyses of natural melilite, Des Cloizeaux deduced the formula  $12R_2O, 2R_2O_3, 9SiO_2$ , which was written by Rammelsberg as  $Na_2(Ca, Mg)_{11}(Al, Fe)_4Si_9O_{36}$ , whilst Groth deduced  $(Ca, Mg)_6(Al, Fe)_2Si_5O_{19}$ .

Vogt has attempted to explain the composition by isomorphous mixtures of gehlenite,  $R_3''R_2'''Si_2O_{10}$ , and äkermanite,  $R_4'''Si_3O_{10}$ , but this is not supported by the analyses. According to Vernadsky's theory of the silicates (*Abstr.*, 1901, ii, 249), the formula may be written as  $R''R_2'''Si_2O_8, nR_2'''SiO_4$ ; Des Cloizeaux's formula will then be  $2R''R_2'''Si_2O_8, 5R_2'''SiO_4$ .

L. J. S.

## Physiological Chemistry.

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**Action of Oxygen on the Sickness produced by Rarefaction of the Air. Experiments on an Orang-Outang.** ALBERTO AGGAZZOTTI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 94—103 and 180—187).—The symptoms observed on the respiration of air at great altitudes are not due alone to the diminished partial pressure of the oxygen. Air rich in oxygen has a beneficial action on the sickness produced by barometric depression, and up to a certain point this beneficial action is proportional to the percentage of oxygen in the inspired air; but with very great rarefactions, the symptoms are observed, whatever the content of oxygen in the air (compare Mosso, *Abstr.*, 1904, ii, 577 and 622). If the amount of carbon dioxide in the inspired air is increased to a certain value, more considerable dilution of the air can be withstood without injurious effects, and the greater the proportion of carbon dioxide the more can the air be diluted. Carbon dioxide does not exert this beneficial action unless its partial pressure in the air exceeds 18 mm. T. H. P.

**Simultaneous Action of Oxygen and Carbon Dioxide on the Sickness produced by Rarefaction of the Air. Experiments on an Orang-Outang.** ALBERTO AGGAZZOTTI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 256—264. Compare *Abstr.*, 1904, ii, 746, and preceding abstract).—Only air which is rich in both carbon dioxide and oxygen can alleviate the ill-effects which are produced by lowering of the barometric pressure. T. H. P.

**Experiments on a Man breathing Carbon Dioxide and Oxygen together under a Barometric Pressure of 122 mm., corresponding with an Altitude of 14,582 Metres.** ALBERTO AGGAZZOTTI (*Atti R. Accad. Lincei*, 1905, [v], 14, ii, 290—297. Compare preceding abstracts).—The results obtained with the orang-outang are confirmed by those given by similar experiments with a man. At a height of 14,500 metres, man suffers no discomfort if the air breathed contains 13 per cent. of carbon dioxide and 67 per cent. of oxygen. T. H. P.

**Restorers of the Cardiac Rhythm.** DAVID J. LINGLE (*Amer. J. Physiol.*, 1905, 14, 433—451).—The conclusion is drawn from experiments on heart-strips that certain agents such as the constant current, induction shocks, and mechanical tension, which have been considered capable of producing rhythmical activity, owe their power to the solution of sodium chloride used with them, which, therefore, cannot be looked on as an indifferent fluid. W. D. H.

**Electric Conductivity of Blood during Coagulation.** ROBERT T. FRANK (*Amer. J. Physiol.*, 1905, 14, 466—468).—No appreciable change occurs in the conductivity of the blood during the coagulation

process. Whether the amount of fibrinogen in the blood is too small to show tangible changes, or whether the numerous chemical and physical changes occurring in the complex process of coagulation exactly neutralise each other could not be determined. The latter explanation appears to be unlikely.

W. D. H.

**Osmotic Pressure of Blood and Urine in Fishes.** M. C. DEKHUYZEN (*Chem. Centr.*, 1905, ii, 1035—1036; from *Arch. Néerland*, [ii], 10, 121—136).—Certain fish, such as the salmon and eel, are able to pass without inconvenience from the sea, where the pressure is great, into fresh water, where the pressure is much lower. Estimation of the freezing points of blood and urine shows that, by the regulating action of the kidneys, fishes, like warm-blooded animals, are able to maintain the osmotic pressure of their blood at a constant level. The osmotic pressure of the blood of warm-blooded animals varies from 6.75 to 7.25 atmospheres, that of different fresh water cold-blooded animals is about 6 atmospheres, that of marine fishes 8.7 atmospheres.

W. D. H.

**Effect of Intravenous Injections of Bile on Blood-pressure.** S. J. MELTZER and WILLIAM SALANT (*J. exper. Med. New York*, 1905, 7, 280—291).—Although, as previous observers have shown, the influence of bile salts on blood-pressure is slight, that of the entire bile is very marked, leading to a great depression of the arterial pressure. The rate of injection makes a considerable difference, rapid injection producing the most marked, or even fatal results. The effect, like that of potassium salts, is mainly cardiac. In some experiments, intravascular coagulation was noticed.

W. D. H.

**Action of Potassium Salts on the Circulatory Organs.** P. TETEUS HALD (*Chem. Centr.*, 1905, ii, 1107; from *Arch. exp. Path. Pharm.*, 53, 227—260).—In rabbits, injection of hypertonic solutions of potassium chloride produces a slow pulse and fall of arterial pressure; sometimes slow but high elevations of the pulse occur. If the dose is not large enough to be immediately fatal, the salt gets into the tissues, and, after about half an hour begins to be eliminated by the kidneys; thus the poison is removed from the body.

W. D. H.

**Resistance of the Corpuscles of Foetal Blood.** ALB. J. J. VANDEVELDE (*Chem. Centr.*, 1905, ii, 1035; from *Ann. Soc. Med. Gand*, 85, 152).—Hamburger has pointed out that the corpuscles of foetal blood are more resistant to saline solutions than are those of the mother. The amount of resistance to 20 per cent. alcohol, amyl alcohol, and absinthe (hæmolytic agents) is about 5 per cent. greater than that of the maternal blood corpuscles.

W. D. H.

**Influence of Concentration of Blood-corpuscles and the Form of the Reagent Vessel on Hæmolysis by Chemical Reagents.** ALB. J. J. VANDEVELDE (*Chem. Centr.*, 1905, ii, 1035; from *Ann. Soc. Med. Gand*, 1905, May).—The rapidity of hæmolysis



increases with the diameter of the vessel employed. The number of blood-corpuscles in narrow tubes has only a small influence on the rapidity of the hæmolytic reaction. W. D. H.

**The Proteids of the Blood.** P. MORAWITZ (*Beitr. chem. Physiol. Path.*, 1905, 7, 153—164).—Some recent researches appear to indicate that the albumin of the blood is in closer relationship to the proteid in the food than the globulin, which some believe is formed at the expense of the albumin. In the present experiments, it is shown that after extensive loss of blood the organism has the power of again forming new proteid matter for the blood, even during hunger, and that the reappearance of the globulin is more rapid than that of the albumin; the latter is probably retained by the organism outside the circulatory system, and during inanition re-enters the blood stream. W. D. H.

**Behaviour of Salt Solutions in the Stomach.** THEODORE PFEIFFER (*Chem. Centr.*, 1905, ii, 1108—1109; from *Arch. exp. Path. Pharm.*, 53, 261—279).—Solutions of sodium sulphate were introduced into the stomachs of dogs with an œsophageal fistula, so that no saliva entered the stomach. After a time, the solution was withdrawn and its freezing point determined. It was found that the stomach wall does not absorb the salt from either hypertonic or hypotonic solutions, but often water passes into the stomach. The exchange of salt between blood and stomach contents is due to simple diffusion. W. D. H.

**Examination of Gastric Contents.** WILLIAM H. WILLCOX (*Trans. Path. Soc. London*, 1905, 56, 250—259).—A description of methods best available for clinical use in dealing with the gastric contents. The principal tests given are those for the hydrochloric acid and organic acids if present, both qualitative and quantitative. Gunzberg's and the dimethylaminoazobenzene reactions are the best for the detection of the former acid.

In gastric and duodenal ulcer, the acidity is usually high, but organic acids are absent. In temporary dyspepsia, nothing noteworthy was found. In malignant growths of the cardiac portion of the stomach, the total acidity is small, often nil; free hydrochloric acid is always absent. In similar growths of the pyloric portion, the acidity is reduced to half the normal, free hydrochloric acid is scarcely ever present, and organic acids are abundant. W. D. H.

**Digestion in Dogs with Artificial Anus.** GEORG MAETZKE (*Inaug. Dissert. Breslau Univ.*, 1905, 1—59).—In dogs with a fistula in the ileum, the outflow from the orifice commences within an hour after feeding, or, if much food is given, within half an hour. Foreign particles (pieces of cork) cause delay. The reaction of the contents of the small intestine to phenolphthalein and turmeric is usually acid, but after flesh feeding alkaline. The reaction to lacmoid and methyl-orange is alkaline, except possibly in the upper part of the duodenum. The variations noted in different regions depend on the

amount and character of the food. Trypsin, diastase and invertase are found in varying quantities in the ileum. Leucine and tyrosine are not found even after large quantities of proteid food. If the food given is not excessive, the absorption of proteid, sucrose, and starch is very complete in the small intestine.

W. D. H.

**The Relationship of the Peptic Digestion Products of Plasteins to Liver Muscles and Other Organs.** II. JOSEPH GROSSMANN (*Beitr. chem. Physiol. Path.*, 1905, 7, 165—174).—Experiments are recorded that show that solutions of plastein-albumoses are not only changed into coagulable proteids by the mucous membrane of the alimentary tract, but also by other organs, such as the liver, large intestine, muscles, and brain.

W. D. H.

**Gastric Digestion of Proteids.** HANS LEO (*Zeit. physiol. Chem.*, 1905, 46, 286—292).—Experiments with fibrin tend to show that, to adopt Ehrlich's nomenclature, pepsin plays the part of a thermolabile amboceptor, and hydrochloric acid that of a thermostable complement in gastric digestion.

W. D. H.

**Pancreatic Secretion.** H. G. CHAPMAN (*Proc. Linn. Soc. N. S. Wales*, 1905, 92—100).—Secretin obtained from the echidna, wallaby, Australian water tortoise, and ibis causes a flow of pancreatic juice in the dog, but apparently not in the echidna. The flow produced by pilocarpine is, and that produced by secretin is not, inhibited by atropine. Stimulation of the vagus does not inhibit secretion due to secretin. The pressure of the fluid in the pancreatic duct is equivalent to nine inches of the juice. Pancreatic juice, so far as its proteolytic property is concerned, can be activated by leucocytes.

W. D. H.

**Action of Pancreatic Juice on Edestin from Cotton Seeds.** EMIL ABDERHALDEN and BÉLA REINBOLD (*Zeit. physiol. Chem.*, 1905, 46, 159—175).—The various crystalline products obtained after the digestion of edestin (from cotton seeds) were separated and identified in the usual way. The opinion is supported that the object of digestion is to break down a "foreign proteid" into simple cleavage products, and that this is essential to enable an animal to synthesise the proteids specific to itself.

W. D. H.

**Chemistry of Digestion in Animals.** II. **Digestion of Proteids in the Alimentary Tract.** E. S. LONDON and A. TH. SULIMA (*Zeit. physiol. Chem.*, 1905, 46, 209—235).—Fistulæ were made in various positions of the alimentary tract in dogs, and proteids of different kinds given as food. The examination of the contents of the canal in different situations and at different intervals after digestion (for albumoses, peptones, crystalline cleavage products, &c.) allows conclusions to be drawn regarding the site and time relationships of digestion and absorption in different parts of the gastro-intestinal tract.

W. D. H.

**Proteid-katabolism.** OTTO COHNHEIM (*Zeit. physiol. Chem.*, 1905, 46, 9—16).—The experiments were made on a dog with a Pawloff's gastric fistula. For several days the animal was given nothing but salt and water; on some days it underwent the process of "sham feeding," which Pawloff has shown causes an abundant flow of gastric juice. But the activity of the digestive organs in itself has no influence on the amount of urinary nitrogen. W. D. H.

**Cage for Metabolism Experiments.** WILLIAM J. GIES (*Amer. J. Physiol.*, 1905, 14, 403—410).—An illustrated description of an animal cage with various devices for collecting excreta, &c., during metabolism experiments. W. D. H.

**Behaviour of Glycyl-*l*-tyrosine in the Dog's Organism after Subcutaneous Injection.** EMIL ABDERHALDEN and PETER RONA (*Zeit. physiol. Chem.*, 1905, 46, 176—178).—Certain polypeptides are easily resolved by, whilst others resist, the action of pancreatic juice. It was, therefore, interesting to know what happens to them when introduced parenterally, that is, without the intervention of the digestive juices, for instance, by subcutaneous administration. Accordingly glycyl-*l*-tyrosine was prepared by Fischer's method; this is a dipeptide which is easily resolved by trypsin. It is also completely split up after subcutaneous injection, both glycine and tyrosine being noticeable in the urine. W. D. H.

**Behaviour of Cystine, Dialanylecystine, and Dileucylcystine in the Organism of the Dog.** EMIL ABDERHALDEN and FRANZ SAMUELY (*Zeit. physiol. Chem.*, 1905, 46, 187—192).—The cystine peptides are easily split up by pancreatic juice; the two mentioned were prepared by Fischer's method and their behaviour compared with that of cystine from horse-hair. The administration was in some cases with the food, in others by subcutaneous injection. By either method, cystine increases the amount of oxidised and neutral sulphur in the urine; the dipeptides behave in exactly the same way. The increased amount of sulphur practically accounts for all the cystine given either alone or in combination. The racemic peptides (leucyl-leucine, leucylglycine, &c.) are similarly broken up. W. D. H.

**Metabolism of Arginine.** WILLIAM H. THOMPSON (*J. Physiol.*, 1905, 33, 106—124. Compare this vol., ii, 268).—If dogs are fed on arginine, the proportion of its nitrogen which reappears as urea varies from 37 to 77 per cent. Part of this is excreted at once, part more slowly, the latter being probably formed by deamidation of the ornithine moiety, and subsequent synthesis of the ammonia into urea. If the arginine is given subcutaneously, the yield of urea-nitrogen is larger. The effects cannot be explained as the result of the solvent (0.9 per cent. sodium chloride) used. The amount of nitrogen excreted as ammonia varies, but averages 10 per cent. of the arginine-nitrogen given. Ornithine, putrescine, or arginine do not appear as such in urine or faeces. In some experiments, a large deficit of nitrogen (37 to 59 per cent.) is accounted for by retention in the body as protoplasm.

W. D. H.



**Metabolism (Albuminous and Saline) in Man.** GEORG VON WENDT (*Chem. Centr.*, 1905, ii, 1109; from *Skand. Arch. Physiol.*, 17, 211—289).—Among the many points raised in this paper are the following: the excretion of sulphur is a better measure of proteid katabolism than that of nitrogen; exogenous is distinguished from endogenous metabolism in relation to purine bases, sulphur, and other substances. The relative constancy of endogenous metabolism is established; the sparing action of non-nitrogenous foods is illustrated; the existence of an "internal circulation" in cell metabolism is suggested.

W. D. H.

**Assimilation of Nitrogen, Phosphorus, Calcium, and Magnesium in Man.** E. GUMPERT (*Chem. Centr.*, 1905, ii, 1036; from *Med. Klinik.*, 1, 1037—1041).—A metabolic comparison of the effects of feeding on "sanatogen" with other forms of diet; some small differences in detail are noticeable.

W. D. H.

**Assimilation of Proteid in Animals.** EMIL ABDERHALDEN and FRANZ SAMUELY (*Zeit. physiol. Chem.*, 1905, 46, 193—200).—Recent research shows that the proteids peculiar to each animal are built up from the simple cleavage products of the proteid in the diet. The biological reaction shows the absence of any foreign proteid in the blood. A horse was bled, and after a hunger interval was fed on gliadin, which yields 36.5 of glutamic acid and 2.37 of tyrosine per cent. These numbers are very different from those obtained from the normal proteids of serum. But in the serum proteids of the new blood the horse made, the proportion of these products remained the same, and was not influenced by the different proportion in the food-proteid. It is not improbable that the liver as well as the intestinal wall plays a part in proteid synthesis.

W. D. H.

**Vegetarianism.** WILHELM CASPARI (*Pflüger's Archiv*, 1905, 109, 473—595).—A very complete study of the subject from several points of view. In the portion dealing with new researches, several experiments were made on human beings, and a complete record kept of their metabolic history. The most severe experiment lasted for ninety-six days on a man who weighed 53 kilos.; at the end of the time he weighed 40 kilos., and in his photograph appears like a skeleton; his main diet was apples and grapes. A pure vegetarian diet is inappropriate, because (1) it is badly absorbed, especially so far as proteids are concerned; (2) it is irritative to the alimentary canal; and (3) because of its large volume. These evils can, to a certain extent, be overcome by the use of certain preparations, but the small proteid intake appears to be insuperable.

W. D. H.

**Autolysis.** O. SCHUMM (*Beitr. chem. Physiol. Path.*, 1905, 7, 175—203).—Details are given of the products of autolysis in the tissues (especially spleen and bone marrow) of cases of leucæmia. In this disease, a proteolytic ferment occurs in the blood, which resembles trypsin in its activities, not pepsin as in some cases of this disease.

W. D. H.

**The Condition of Living Substance.** HUGO FISCHER (*Zeit. physiol. Chem.*, 1905, 46, 206—208).—Polemical against E. Buchner on the nature of the chemical processes of life, and as to how far the action of enzymes is to be considered a portion of the chemistry of life (compare Buchner and Antoni, this vol., ii, 472).

W. D. H.

**Cholesterol Esters in the Brain.** R. BÜNZ (*Zeit. physiol. Chem.*, 1905, 46, 47—51).—Baumstark (Abstr., 1885, 918) stated that the brain contains not only cholesterol, but cholesterol esters as well. In the present research, this is not confirmed; the ethereal extract contains no esters of cholesterol with higher fatty acids, or any other compounds of cholesterol from which cholesterol is separated by saponification.

W. D. H.

**The Ereptic Power of Tissues as a Measure of Functional Capacity.** HORACE M. VERNON (*J. Physiol.*, 1905, 33, 81—100).—The erepsin in the tissues of guinea-pig, cat, and rabbit increases *in utero* and for a few days after birth; then it remains constant. The increase is 5- or even 10-fold in kidney and liver, but slight in muscle. Feeding with meat in cats doubles the amount in spleen and liver, but does not affect other tissues. The distribution of erepsin in the alimentary canal is unequal; on a mixed or meat diet in cats, the duodenum is richest in the ferment; on a bread and milk diet, this falls, and the amount in the large intestine rises. In the herbivorous rabbit, the alimentary canal is altogether poorer in erepsin, especially in the duodenum. Hibernation lessens the erepsin in spleen, liver, and kidney, but not in brain or muscle. Disease, if accompanied by wasting, has the same effect.

W. D. H.

**Mytolin, a Proteid from Muscle.** W. HEUBNER (*Chem. Centr.*, 1905, ii, 1106; from *Arch. exp. Path. Pharm.*, 53, 302—312).—From rigorized horse-flesh, ammonia or 10 per cent. sodium chloride solution extracts a proteid matter named *mytolin*. When, by dialysis, the concentration of the salt solution is reduced to 2—3 per cent., it is precipitated in a comparatively insoluble form. By further dialysis, a globulin is precipitated. By the action of carbon dioxide and repeated solution in very dilute sodium carbonate, a part of the globulin is transformed into mytolin. Neutralisation of a saline extract of muscle precipitates mytolin, but leaves the globulin in solution.

W. D. H.

**Hexone Bases of Liver Tissue.** ALFRED J. WAKEMAN (*J. exper. Med. New York*, 1905, 7, 292—307. Compare this vol., ii, 467).—The results reported show that in degenerating liver tissue, chemical changes in the cells lead to a diminution of the hexone bases, but especially of arginine. How much arginine passes into the urine, or is acted upon by arginase, is uncertain. The changes during degeneration have the same general direction as in *post-mortem* autolysis.

W. D. H.

**Grafting of the Thymus in Animals.** LEONARD S. DUDGEON and A. E. RUSSELL (*Trans. Path. Soc. London*, 1905, **56**, 238—250).—The experiments were undertaken with the idea of observing whether grafting of the thymus gland would produce any alteration in the blood, or any condition resembling lymphatism, in which the thymus is known to play a part. The results were negative. W. D. H.

**Lanocerin.** FRANZ RÖHMANN (*Zentr. Physiol.*, 1905, **19**, 317—320).—Lanocerin is the name given to a new constituent of wool-fat, from which it can be prepared by boiling with methyl alcohol and then extracting the residue with ether. It is precipitated from this solution by alcohol. By boiling with alcoholic potash, the potassium salt of lanoceric acid (Darmstädter and Lipschutz, *Abstr.*, 1896, **i**, 522) is obtained. Lanocerin is an inner anhydride of this acid. The carnaubic acid of the same authors (*Abstr.*, 1896, **i**, 346; 1897, **i**, 180) is probably an impure product. The sebaceous glands yield a substance named *dermocerin*, the nature of which is uncertain. The anal glands do not secrete cholesterol, but an ester of octadecyl alcohol named *pennacerin*. The relationship of such substances to cholesterol and oleic acid is discussed. W. D. H.

**Local Anæsthesia produced by Alypin.** E. IMPENS (*Pflüger's Archiv*, 1905, **110**, 21—87).—The hydrochloride of alypin [tetramethyldiaminoethyldimethylcarbinyl benzoate,  $\text{OBz} \cdot \text{Cet}(\text{CH}_2 \cdot \text{NMe}_2)_2$ ] is recommended as a local anæsthetic; it is at least as powerful as cocaine, and much less toxic. It does not produce mydriasis or any interference with accommodation. W. D. H.

**Contractile Mechanism of the Gall-bladder.** FRANCIS A. BAINBRIDGE and H. H. DALE (*J. Physiol.*, 1905, **33**, 138—155).—The rhythmic contractions of the gall-bladder are increased by section of the splanchnic nerves or by the intravenous injection of chrysotoxin. Stimulation of these nerves or injection of adrenaline causes relaxation. The vagus contains motor fibres which are paralysed by atropine. Bile salts, amyl nitrite, and atropine cause relaxation; pilocarpine and peptone cause an apparent contraction, due to the mechanical effect of swelling of the liver. The anæmia caused by compression of the aorta produces a rapid fall in the tone of the muscle of the gall-bladder. W. D. H.

**A New Nitrogenous Constituent of Normal Human Urine.** PAUL HÁRI (*Zeit. physiol. Chem.*, 1905, **46**, 1—8).—The zinc, silver, and cadmium compounds of a new constituent of the urine, precipitable therefrom by a 10 per cent. solution of phosphotungstic acid, were prepared and analysed. It contains carbon, hydrogen, nitrogen, and oxygen, but has not yet been isolated from its metallic compounds. It is not urobilin, but appears to have a possible relationship to Garrod's urochrome. W. D. H.

**Excretion of Sugar after Administration of Alanine in Dogs without a Pancreas.** MARCO ALMAGIA and GUSTAV EMBEN (*Beitr. chem. Physiol. Path.*, 1905, **7**, 298—310).—After extirpation of the



pancreas, the sugar which appears in the urine is considered to originate solely from carbohydrate material which is newly formed in the body. Alanine produces such a new formation of carbohydrates.

W. D. H.

**Precipitability of Carbohydrates in Urine by Lead Acetate.** OSCAR ADLER and RUDOLF ADLER (*Pflüger's Archiv*, 1905, 110, 99—103. Compare this vol., ii, 337).—Proofs are adduced that lævulose may occur in the urine, and is partially precipitated (like arabinose and dextrose) by lead acetate.

W. D. H.

**A Non-dialysable Proteid-like Constituent of Human Urine.** EMIL ABDERHALDEN and FRITZ PREGL (*Zeit. physiol. Chem.*, 1905, 46, 19—23. Compare this vol., ii, 467).—Urine contains a substance which yields glycine and phenylalanine on decomposition and appears to belong to the polypeptides.

W. D. H.

**The Globulin of Albuminous Urine.** A. W. SIKES (*J. Physiol.*, 1905, 33, 101—105).—In albuminous urine, the globulin increases somewhat on keeping at the expense of the albumin. The change occurs more readily in alkaline urine, and is probably not due to bacterial action. Albumose added to globulin solutions does not increase the amount of the latter substance. Electrical currents passed through the urine increase the globulin probably by heating the urine.

W. D. H.

**The Chromogen of so-called Scatole-red in Normal Human Urine.** J. PH. STAAL (*Zeit. physiol. Chem.*, 1905, 46, 236—262).—The chromogen of the so-called scatole-red in normal human urine is not a conjugated sulphate (for instance, of glycuronic acid). It is not a derivative of scatole in the chemical sense of that term, but is identical with the uroscopin of Nencki and Sieber.

W. D. H.

**A Prehistoric Egyptian Calculus.** SAMUEL G. SHATTOCK (*Trans. Path. Soc. London*, 1905, 56, 275—290).—The examination of the calculus, which was obtained from a tomb of date 4800 B.C., showed it to consist of uric acid coated with phosphates; calcium oxalate was absent. A second calculus, probably renal, and 600 years later in date, was found to consist of calcium carbonate, phosphate, and oxalate.

The paper contains much of archaeological interest, especially with regard to the diseases and diet of the ancient Egyptians. No Bilharzia ova, the chitinous nature of the capsules of which would render them likely to be well preserved, were found in either stone. The second stone, however, contained numerous mould conidia, but attempts to cultivate these were fruitless.

W. D. H.

**Virulence and Immunising Power of Micro-organisms.** RICHARD P. STRONG (*J. Exper. Med. New York*, 1905, 7, 229—264).—From experiments on two strains of cholera vibrio differing in virulence, it is shown that the number or the avidity of the bacterio-

lytic receptors possessed by a bacterium is proportional to its virulence. The agglutinable receptors are not necessarily present in the same proportion. The virulent organism possesses more toxic haptophore groups than the avirulent. Immunity produced by injecting dead organisms is proportional to their original virulence, but if the living organisms are used the proportion is not so direct. W. D. H.

**Stimulins.** W. B. LEISHMAN (*Trans. Path. Soc. London*, 1905, 56, 344—355).—The favouring effect of the addition of immune serum on the phagocytic action of leucocytes was originally attributed by Metschnikoff to a stimulating effect on the leucocytes, and the term *stimulin* was coined by him as a name for the substance in the serum to which the effect is due. In the present experiments, serum from cases of Malta fever and typhoid fever (but not normal serum) was found to possess the power of increasing the phagocytic activity of the leucocytes on the specific bacilli of those diseases. These substances are thermostable, withstanding a temperature of 60° for fifteen minutes. The increased phagocytosis may be in part due to the presence of agglutinins or of immune substance in the serum. The view is held that the main effect is a stimulating one on the leucocytes, and not due to the addition of an opsonin to the bacilli. Wright's hitherto described opsonins are destroyed by a temperature of 60°. It is, however, admitted that there may be a class of opsonins which are thermostable, a view Metschnikoff appears now also inclined to accept.

W. D. H.

[**Glycosuria**]. EDUARD PFLÜGER (*Pflüger's Archiv*, 1905, 110, 1—20).—Polemical against Minkowski.

W. D. H.

**Experimental Glycosuria.** FRANK P. UNDERHILL (*J. Biol. Chem., New York*, 1905, 1, 113—130. Compare this vol., ii, 187).—The glycæmia provoked by piperidine, pyridine, coniine, curare, nicotine, morphine, ether, chloroform, carbon monoxide, pyrogallol, &c., is not due to any specific action on any particular organ, such as the pancreas, but to their action in producing dyspnoea. If oxygen is also administered, it does not appear. Adrenaline diabetes cannot, however, be explained in this way.

W. D. H.

**Opsonic Content of Blood Serum in Health and in Lupus.** WILLIAM BULLOCK (*Trans. Path. Soc. London*, 1905, 56, 334—344).—Films made from blood mixed with tubercle bacilli were prepared and examined according to Wright's technique. The bacilli are counted in the leucocytes, and an average per leucocyte struck. If this is done after admixture with (1) an abnormal and (2) a normal serum, the average for leucocyte in the first case divided by that in the second is called the opsonic index. In 86 healthy people, the index was 0·97, the extremes being 0·8 and 1·2. In tuberculosis of the skin (lupus), the average was 0·75 in 150 cases. In 75 per cent. of these, the index was below the lowest normal limit, 0·8, and in 27 cases below 0·5; in 3 cases as low as 0·2. If the index is well below the normal, Finsen light treatment is of little or no benefit. The ultra-

violet rays have but little penetrative power, and probably exert no potent effect on tubercle bacilli. The healing properties in cases with high opsonic index are due to a reaction set up in the tissues and to the congestion and exudation that follow exposure to the rays.

W. D. H.

**Behaviour of Leucocytes in Malignant Growths.** J. E. FARMER, J. E. S. MOORE, and C. E. WALKER (*Trans. Path. Soc. London*, 1905, 56, 377—380).—In the early stages of a cancerous growth, there is marked activity among, and increase of, leucocytes, and there is evidence that the new growth does not originate from a single cell or even from a few cells, but is evolved by the direct conversion of normal cells into those of a malignant type. The tissue cells take up the leucocytes, but neither are injuriously affected or eventually destroyed, and both continue to divide mitotically; both nuclei pass through the mitotic evolution either on separate spindles or the spindle figures may become confused, as occurs in the first cleavage of the ovum. The two sets of chromosomes are confusedly distributed between the daughter nuclei, and the process may thus be compared to fertilisation. The reduction of chromosomes so characteristic of neoplastic cells must occur later.

W. D. H.

**Metabolism in Osteomalacia.** J. E. GOLDTHWAIT, C. F. PAINTER, R. B. OSGOOD, and FRANCIS H. MCCRUDDEN (*Amer. J. Physiol.*, 1905, 14, 389—402).—Metabolism experiments on a girl aged sixteen suffering from osteomalacia were carried out during two periods: (1) before, and (2) after castration. There is first a decalcification of the bony tissue; the calcium is replaced partly by magnesium, but probably chiefly by an organic substance rich in sulphur, but poor in phosphorus, similar to, but not exactly like, the normal organic matrix. Castration checks the progress of the disease, and the lost bony material is replaced.

W. D. H.

**The Opsonic Index in Phthisis.** HAROLD MEAKIN and CHARLES E. WHEELER (*Brit. Med. J.*, 1905, ii, 1396—1397).—The observations show the great variations in opsonic index in cases of pulmonary tuberculosis, and even in the same case, especially during the early stages of the disease. When the case becomes chronic, the opsonic index is fairly stationary; if it is then one or over, prognosis is better than when it is below unity.

W. D. H.

**Enzymes and Anti-enzymes of Exudates.** EUGENE L. OPIE (*J. Exper. Med. New York*, 1905, 7, 316—334).—The serum of an inflammatory exudate inhibits the action of the proteolytic enzymes contained in the leucocytes; the anti-enzyme doubtless passes from the blood into the exudation. In late stages of inflammation, this inhibiting action is lessened. The anti-enzyme is destroyed by heating at 75°.

The proteolytic enzymes of the leucocytes act in both an acid and alkaline medium, but are more efficient in the latter. The action of the anti-enzyme is favoured by an alkaline, and completely lost in an acid medium.

W. D. H.



[Physiological] **Action of Barium Chloride and of Barutine.** H. BRAT (*Chem. Centr.*, 1905, ii, 1189; from *Berl. klin. Woch.*, 42, 1219—1225).—"Barutine" is the double salt formed by the combination of barium theobromine with sodium salicylate. It is a white, crystalline powder and is soluble in water. Barium theobromine, prepared by the action of barium chloride on sodium theobromine, is insoluble in water. The preparation contains 9.5 per cent. of barium, 25.5 of theobromine, 50 of sodium salicylate, and about 10 of water and sodium chloride; since it is faintly alkaline, it requires to be kept in an atmosphere free from carbon dioxide. Whilst a dose of 0.113 gram of barium chloride per kilogram of body-weight is fatal to dogs when administered either internally or subcutaneously, barutine is at least nine times less poisonous. Experiments on the physiological action and therapeutic application of barutine as a diuretic have also been made. E. W. W.

**Action of Adrenaline on Cerebral Vessels.** CARL J. WIGGERS (*Amer. J. Physiol.*, 1905, 14, 452—465).—Perfusing the isolated brain under constant pressure and temperature and recording the venous outflow was the method adopted. Addition of adrenaline to the perfusion fluid lessens the outflow, owing no doubt to constriction of the vessels which the drug produces here as elsewhere. The existence of vaso-motor nerves in the cerebral blood-vessels is thus proved experimentally. W. D. H.

**Action of Synthetical Substances allied to Adrenaline.** OTTO LOEWI and HANS MEYER (*Chem. Centr.*, 1905, ii, 1111—1112; from *Arch. exp. Path. Pharm.*, 53, 213—226).—Stolz's methylaminoacetylcatechol, probably the corresponding ketone to adrenaline, has a similar but weaker physiological action. Of Stolz's other products, the simple amino-ketones show the strongest action, that of the ethyl being more marked than that of the methyl compound. Dialkylamino-ketones, monoethanolamino-ketones, and phenylaminoacetylcatechol are inactive; piperidinoacetylcatechol has only a weak action. Reduction of the amino-ketone produces an amino-alcohol not yet obtained pure, but similar to adrenaline. The active products like adrenaline act on blood pressure, respiration, and the iris muscles, and produce diabetes. Given subcutaneously they also cause the same results. Hydrochlorides of some of these bases were prepared in crystalline form. W. D. H.

**Hippuric Acid Synthesis.** WILHELM WIECHOWSKI (*Beitr. chem. Physiol. Path.*, 1905, 7, 204—272).—A study of the pharmacological action of benzoic acid given in various ways to rabbits. The amount given is not wholly excreted as hippuric or benzoic acids; the longer it remains in the body the greater is the amount of hippuric acid synthetically formed. Glycine as an intermediate metabolic product is considered at some length. More than half the urea-nitrogen is believed to pass through the glycine stage. Descriptions of analytical methods and references to literature are given in full. W. D. H.

**Physiological Action of Physostigmine.** W. HEUBNER (*Chem. Centr.*, 1905, ii, 1111; from *Arch. exp. Path. Pharm.*, 53, 313—330).—Experiments on frogs, mammals, and man show that no immunity can be produced to physostigmine. In a dog, that received 60 mg. in 19 days, only 2 mg. were recovered in the urine. Physostigmine-blue, a derivative of physostigmine, is not poisonous in small doses; larger doses paralyse the heart and central nervous system in frogs. Another derivative, rubreserin, is inactive. The alkaloid itself has the constitution  $\text{NHMe}\cdot\text{CO}\cdot\text{NH}\cdot\text{C}_{13}\text{H}_{15}\text{N}\cdot\text{OH}$ . It splits into eseroline and rubreserin; the latter in alkaline solution is changed into physostigmine-blue, the composition of which is unknown. It forms brown, amorphous products on drying and evaporation. W. D. H.

**Influence of Thyroid Feeding on Poisoning by Acetonitrile.** REID HUNT (*J. Biol. Chem.*, 1905, 1, 33—44).—Proteids increase the susceptibility of mice to acetonitrile, whilst thyroid feeding (and potassium iodide to a slight extent) decreases it. Thyroid has no antagonistic action towards sodium nitroprusside or free hydrocyanic acid. Feeding on parathyroids has the opposite effect to thyroid feeding. W. D. H.

**Action of Certain Poisons on the Isolated Small Intestine of Dogs and Rabbits.** K. KRESS (*Pflüger's Archiv*, 1905, 109, 608—620).—The work was carried on by Magnus' method. Nicotine causes first inhibition, then stimulation; larger doses produce paralysis. Certain differences are noticeable in detail in different animals. Atropine in the cat, but not in the dog or rabbit, acts antagonistically to nicotine. There are also differences in the antagonistic actions of physostigmine and atropine and of pilocarpine and atropine. The action of a number of other poisons (strophanthine, apocodeine, barium chloride, adrenaline, &c.) was also studied. W. D. H.

**Isoform, a New Antiseptic.** BERNHARD HEILE (*Volkmann's Sammlung klin. Vorträge, Leipzig*, No. 388, 149—164); WEIK (*Med. Klinik., Berlin*, 1905, No. 19).—Isoform (*p*-iodoanisole) is recommended as a local antiseptic, being better than iodoform; it is non-irritating, odourless, and non-toxic. W. D. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Influence of Metals on Fermenting Liquids.** LEOPOLD NATHAN, ARTHUR SCHMID, and WILLY FUCHS (*Centr. Bakt. Par.*, 1905, ii, 15, 349—352. Compare Abstr., 1904, ii, 505, and this vol., ii, 340).—The contact of beer worts before and during the fermentation with metals, whether copper, iron, or tin, should be avoided as much as possible. N. H. J. M.

**Origin of Fusel Oil. An Alcohol-producing Bacterium.** HANS H. PRINGSHEIM (*Centr. Bakt. Par.*, 1905, ii, 15, 300—321).—Fusel oils produced from different materials are very similar and contain, besides amyl alcohol, considerable amounts of propyl and isobutyl alcohols and small amounts of other alcohols. Normal butyl alcohol is not present.

All bacteria which produce higher alcohols produce normal butyl alcohol, whilst amyl alcohol has not been detected. Emmerling's potato bacteria produces propyl alcohol, the potato bacillus isopropyl alcohol, Grimbert's *B. orthobutyricus* isobutyl alcohol, whilst a number of bacteria produce normal butyl alcohol, together with butyric acid. Bacteria which produce alcohols (except Winogradski's *Clostridium Pasteurianum*) produce far more butyric acid than corresponds with the composition of fusel oil.

The view that fusel oil is produced by bacteria is therefore incorrect; the higher alcohols are probably formed by the decomposition of yeast-proteid.

N. H. J. M.

**Action of the Rennet Ferment on Milk and Casein.** ERNST LAQUEUR (*Biochem. Centr.*, 1905, 4, 333—347).—A *résumé*, with bibliography, of the more important work on the subject.

N. H. J. M.

**Apparatus for the Cultivation of Anaërobic Bacteria and for the Estimation of the Oxygen-minima for Germination, Growth, and Spore-production of Bacteria.** ARTHUR MEYER (*Centr. Bakt. Par.*, 1905, ii, 15, 337—349).—The apparatus, consisting of an air-pump with a new form of drying tube, cylindrical vacuum vessels, and manometer, is described with sketches.

N. H. J. M.

**Acidifying and Fermenting Yeast Mash. (Behaviour of *Bacillus Delbrücki* at Different Temperatures.)** WILHELM HENNEBERG (*Centr. Bakt. Par.*, 1905, 15, ii, 260—265; from *Zeit. Spiritusind.*, 1905, No. 26—29).—The bacilli from mash cultures heated at 51° failed to grow both at higher and lower temperatures, being weakened chiefly by the acid present. In presence of calcium carbonate, no weakening was observed. Cultures heated at 38° without calcium carbonate showed a good growth after four days, although 1·2 per cent. of lactic acid was present. The mash, which had been heated at 51°, contained 0·9 per cent. of acid. The weakening is, therefore, due both to acid and to the high temperature.

The greater the number of cells sown, the greater the development and the shorter the cells. The length of the cells is also affected by the temperature; at 50°, the cells are short, at 40°, much longer, whilst at 30° the cells are extremely long.

N. H. J. M.

**Influence of Temperature on the Assimilation of Carbon Dioxide.** ARISTIDES KANITZ (*Zeit. Elektrochem.*, 1905, 11, 689—690).—From the experiments of Matthaei (Abstr., 1904, ii, 70) it is shown that the rate of assimilation of carbon dioxide by green leaves



increases with the temperature in the ratio commonly found for chemical reactions.

Temperature.	Assimilation rate.	Increase for 10°.
0	1.75	—
10	4.2	2.40
20	8.9	2.12
30	15.7	1.76
37	23.8	1.81

From 37° to the temperature at which the leaf is killed, the rate rapidly diminishes. T. E.

**Physiological Processes of Green Leaves, with Special Reference to the Interchange of Energy between the Leaf and its Surroundings.** HORACE T. BROWN and FERGUSON ESCOMBE (*Proc. Roy. Soc.*, 1905, B, 76, 29—111. Compare Abstr., 1902, ii, 682).—The rate of carbohydrate formation (assimilation) in a leaf surrounded by an atmosphere containing about the normal proportion of carbon dioxide (0.03 per cent.) is determined by passing a known volume of air over the leaf and finding by analysis the proportion of carbon dioxide present before and after the experiment. Since one part by weight of carbon dioxide corresponds with about 0.64 part by weight of carbohydrate, the amount of the latter produced in a given time can readily be calculated. The results obtained by this method are much lower than those deduced by Sachs' method (determination of the variations in dry weight of known areas of leaf lamina), and the authors, from their experiments, draw the conclusion that there are inherent errors in the latter method which render it unsuitable for determining the rate of assimilation.

As an illustration of the results obtained, it was found that a sun-flower leaf, exposed to strong diffused light, assimilated 0.00392 gram of carbohydrate per square decimetre per hour. The rate of assimilation under similar conditions is about 45 per cent. greater in detached than in attached leaves; this is due, in all probability, to the stomata being more widely open in the former case.

The question of the energy relations of the leaf is fully discussed. For this purpose it is necessary to know the amount of solar energy incident on the leaf, the amount absorbed, and the amount of heat lost by radiation, convection, &c., in unit time, as well as the energy changes associated with the more important physical and chemical changes going on in the leaf, such as the evaporation of water, carbohydrate formation, and the process of respiration. The influence of the rate of motion of the air on some of these factors is taken into account.

The incident solar energy is measured by a Callendar radiometer and recorder, and the proportion absorbed determined with the same instruments by interposing the leaf and measuring the amount transmitted. The amount of heat developed in respiration is calculated from the amount of carbon dioxide given off on the assumption that carbohydrates are undergoing oxidation (Brown and Morris, Trans.,

1893, 63, 671). The energy absorbed in assimilation is calculated from the amount of carbon dioxide absorbed and the average heat of formation of the synthesised carbohydrates. The energy used up in the vaporisation of water is calculated from the amount of vapour evolved in a given time (determined directly) and the latent heat of vaporisation. The following results, obtained with a sunflower leaf, illustrate the relative magnitudes of these factors :

Energy used for assimilation . . . . .	0.66
"    "    " vaporisation of water . .	48.39
<hr/>	
Total energy expended in internal work	49.05
Solar radiant energy transmitted by leaf	31.40
Energy lost by radiation, convection, &c .	19.55
<hr/>	
Total incident energy . . . . .	100.00

The leaf is, therefore, a very wasteful transformer of energy, as in the example quoted only 0.66 per cent. is used for the production of formative material.

When the solar energy absorbed is greater than the energy expended in internal work, the leaf comes to equilibrium at a temperature higher than its surroundings. The temperature difference can be found by dividing the energy lost by radiation, convection, &c., by the "thermal emissivity" of the leaf (the energy lost by radiation, convection, &c., when the leaf is at a temperature 1° above its surroundings), a special method for determining the latter factor having been devised. When, owing to active transpiration, the energy expended in internal work is greater than the solar energy absorbed, the leaf takes up heat from the atmosphere and comes to equilibrium at a temperature slightly lower than that of its surroundings.

The solar energy can be reduced to a fraction of its value without seriously affecting the rate of assimilation, so that even in diffused daylight the available energy is more than sufficient to give the maximum effect; assimilation is, under ordinary conditions, limited by the small concentration of the carbon dioxide.

Tables showing the distribution of the energy under varying conditions are given in the paper. G. S.

**Occurrence of Alumina in Plants.** HENRI PELLET and CH. FRIBOURG (*Ann. Chim. anal.*, 1905, 10, 373—376. See this vol., ii, 860).

**Consumption of Odorous Products during the Maturation of the Flower.** EUGÈNE CHARABOT and ALEXANDRE HÉBERT (*Bull. Soc. chim.*, 1905, [iii], 33, 1121—1128. Compare Abstr., 1904, ii, 837).—The authors have investigated the changes induced both in the amount and nature of the volatile oil produced by the sweet basil (*Ocimum basilicum*) as the result of systematically removing the flowers as these appear on the plant. The results are tabulated in the original, and show that the removal of the inflorescence leads (1) to an increase in the size of the stem of the plant, (2) to an increase in

the amount of oil produced per unit weight of plant substance, and (3) that the processes of fertilisation and fructification lead to the consumption of some of the odorous constituents or of intermediate substances from which these are produced.

T. A. H.

### The Carbohydrates of Marine Algæ and their Products.

JOSEF KÖNIG and J. BETTELS (*Zeit. Nahr. Genussm.*, 1905, 10, 457—473).—The general composition, the carbohydrates, and the products obtained on hydrolysis of various East Asiatic algæ are given. The composition of the different sea-weeds varies very considerably, the *Porphyra* group being rich in proteids, whilst *Laminaria*, *Cystophyllum*, and *Enteromorpha* contain from 6.66 to 10.87 per cent. of pentosans, the latter sea-weed also containing 16.52 per cent. of methylpentosans. In all, the percentage of ash is very high. *Porphyra*, from which the Japanese vegetable isinglass "Nori" is prepared, and *Gelidium*, which yields agar-agar, both give *i*-galactose and *d*-galactose, these anhydrides being also found in the products nori and agar-agar. The authors have examined samples of edible birds' nests and find that they contain but small quantities of substances which yield reducing sugars, only fructose being identified with certainty. The nests contained from 50 to 60 per cent. of nitrogenous substances resembling mucin, and it is perfectly legitimate to conclude that edible bird nests are produced from the vomit of sea-swallows.

W. P. S.

**Constituents of the Fruits of *Copaifera Mopane*.** CARL MAI and C. RATH (*Arch. Pharm.*, 1905, 243, 426—430).—Chloroform extracts from the seeds a balsam with the acid number 57.4 and saponification number 212. From this a small quantity of a substance crystallised which melts at 96°, is free from nitrogen and metals, and contains C 74.7, H 11.5 per cent. From an ethereal solution of the residual balsam, 5 per cent. aqueous sodium carbonate extracted acids of which the lead salts were in part soluble in ether; the acid corresponding to this portion was amorphous and formed a *barium* salt which contained Ba 36.1 per cent. The residual balsam was then hydrolysed with 5 per cent. potassium hydroxide solution, and the acids liberated; of these, one fraction crystallised from 70 per cent. alcohol and melted at 77°, but was not homogeneous; the residue was not homogeneous either.

C. F. B.

**Root of *Rheum Rhaponticum*.** ALEXANDER TSCHIRCH and U. CRISTOFOLETTI (*Arch. Pharm.*, 1905, 243, 443—457. Compare Hesse, *Abstr.*, 1900, i, 41, and Gilson, *Bull. acad. roy. méd. Belg.*, 1903).—The powdered root of *Rheum rhaponticum*, of Austrian origin, was extracted with 70 per cent. alcohol, and the extract evaporated to small bulk and then extracted with ether. During the last operation, a substance separated identical with the substance described originally by Hornemann as *rhaponticin* (Hesse's rhapontin; Gilson's ponticin). This melts at 231°, has the composition  $C_{21}H_{24}O_9 = OMe \cdot C_{20}H_{19}O_6(OH)_2$ , forms a *diacetyl* derivative melting at 138°, gives an odour of oil of bitter almonds when it is warmed on a watch-glass with dilute nitric



acid, and is hydrolysed when heated cautiously with dilute sulphuric acid to dextrose and rhapontigenin (Gilson); it does not yield chrysamic acid when treated with nitric acid. Rhapontigenin has the composition  $C_{17}H_{22}O_3 = OMe \cdot C_{16}H_{17}(OH)_2$ ; its *dibenzoyl* and *diacetyl* derivatives melt at 145—146° and 110—112° respectively.

The ethereal extract was evaporated, and the residue digested with cold 10 per cent. aqueous sodium carbonate. Chrysophanic acid remained undissolved, melting at 181—182° and still containing 1.48 per cent. of methoxyl (for the substance which is completely freed from methoxyl, 5 : 8-dihydroxy-1-methylantraquinone, which melts at 196°, the name of *chrysophanol* is proposed). From the alkaline solution, a yellow substance,  $C_{16}H_{16}O_5 = OMe \cdot C_{15}H_{13}O_4$ , melting at 216°, is obtained; this is presumably a *dihydroxymethoxymethyltetrahydroanthraquinone*. Neither emodin nor rhein could be detected.

The liquid remaining after the extraction with ether was hydrolysed with 3 per cent. alcoholic potassium hydroxide. The products were rheum-red, rheonigrin, dextrose, and an orange-red *dihydroxydimethyltetrahydroanthraquinone*,  $C_{16}H_{16}O_4$ , which melts at 195—196° and forms a yellow *diacetyl* derivative melting at 205°.

After extraction with 70 per cent. alcohol, the material was extracted with 95 per cent. alcohol, which dissolved chrysophanic acid and an anthraglucoside which yielded *d*-glucose and dihydroxydimethyltetrahydroanthraquinone.

From a sample of the roots cultivated in Berne, dihydroxymethoxymethyltetrahydroanthraquinone, emodin, and rhein could not be isolated, and anthraglucosides were present only in small amount.

C. F. B.

**The Existence of a Cyanogenetic Compound in *Thalictrum Aquilegifolium*.** LEOPOLD VAN ITALLIE (*J. Pharm. Chim.*, [vi], 22, 337—338).—The leaves of *Thalictrum aquilegifolium* contain a glucoside resembling phaseolunatin (compare Dunstan and Henry, *Abstr.*, 1904, ii, 71), for on hydrolysis with emulsin it yields hydrogen cyanide and acetone, one kilogram of the leaves producing 0.502 to 0.6 gram of hydrogen cyanide. The leaves of *Thalictrum flavum*, *T. minus*, or *T. glaucum* do not furnish hydrogen cyanide under the same conditions.

M. A. W.

**Chemistry of the Scleroderms.** MAX BAMBERGER and ANTON LANDSIEDL (*Monatsh.*, 1905, 26, 1109—1118. Compare *Abstr.*, 1903, ii, 567).—Unripe specimens of *Lycoperdon bovista* from the Pitztal, in Tyrol, were extracted with 96 per cent. alcohol at the ordinary temperature and again at the boiling point.

The first extract yielded tyrosine and a substance which contains C = 40.59, H = 4.79, N = 26.24 per cent.; it crystallises in sheaves of glistening, white needles, becomes yellow at 215° and dark brown at 240°, is easily soluble in aqueous sodium hydroxide, gives a yellowish-red coloration with concentrated sulphuric acid, forms an intense yellowish-brown solution when boiled with Moerner's tyrosine reagent, and when evaporated with dilute nitric acid yields a lemon-yellow residue, which darkens on treatment with ammonia and becomes

reddish-yellow on addition of sodium hydroxide. With silver nitrate in aqueous solution, it forms a transparent jelly, or in dilute solution a flocculent precipitate which becomes opaque on addition of baryta water; on addition of lead acetate, the aqueous solution becomes opaque, and in presence of a small quantity of ammonia forms a white, flocculent precipitate; with phosphotungstic acid in very dilute sulphuric acid solution, the substance forms a yellow, flocculent precipitate.

The second extract yielded (a) two substances melting at 158—159° and 163·5—164° respectively, which are closely related to ergosterol (compare Hofmann, *Inaug. Diss.*, Zurich, 1901), crystallises in long needles or hexagonal plates, are easily soluble in hot ether or chloroform, and give the cholesterol reactions; and (b) a substance which contains C = 64·48, H = 11·41, N = 1·48 per cent., and belongs probably to the cerebroside group; it separates from acetic acid as a loose white powder, becomes yellow at 165°, melts at 180—200°, is decomposed by warm concentrated sulphuric acid, and when boiled with dilute sulphuric acid forms a substance which reduces Fehling's solution when heated.

G. Y.

**Measure for the Action of Poisons on Plants.** EDUARD VERSCHAFFELT (*Chem. Centr.*, 1905, ii, 1033; from *Arch. Néerland*, ii, 10, 1—7).—The fact that a dead cell does not increase, but rather decreases, in weight in water is utilised as a means of measuring the external influences sufficient to cause the death of cells.

The poisonous limit of copper sulphate after twenty-four hours' action on potato starch is between 0·03 and 0·05 per cent. Sodium chloride is poisonous in 2·34 per cent. solutions, whilst 1·75 per cent. is without action; in the case of parts of mangolds the strength has to be 3—5 times as great to exert a poisonous action. Potassium bromide and nitrate resemble sodium chloride; dextrose and sucrose act similarly in only slightly greater concentration. Addition of certain amounts of sodium chloride diminish the poisonous action of quinine hydrochloride, whilst larger amounts increase the poisonous action. The poisonous action of oxalic acid is partially neutralised by sodium chloride and also, in a less degree, by sucrose.

N. H. J. M.

**Insensibility of Higher Plants towards their own Poisons.** G. J. STRACKE (*Chem. Centr.*, 1905, ii, 1033—1034; from *Arch. Néerland*, [ii], 10, 8—61).—Tissues of higher plants may be insensible towards their own poisons, but this is not always the case. The same cells may be insensible towards other poisons than those to which they are accustomed. It is probable that in some cases poisonous liquids obtained from plants only become poisonous after their separation owing to the action of enzymes.

Of the various acids investigated, the most poisonous are hydrochloric and oxalic acids; the less poisonous acids, tartaric, citric, malic, and lactic acids, are about equal among themselves.

Alkaloids are only slightly poisonous towards higher plants; the most poisonous is quinine hydrochloride, and strychnine hydrochloride is more poisonous than the nitrate.

N. H. J. M.

**Glyceria Fluitans, an almost forgotten Cereal.** C. HARTWICH and G. HÅKANSON (*Zeit. Nahr. Genussm.*, 1905, 10, 473—478).—This grain is known under a variety of names, such as manna-grass, manna-millet, &c. A sample examined by the authors gave the following results: water, 13.54; proteids, 9.69; fat, 0.43; starch and sugar, 75.06; crude fibre, 0.21; ash, 0.61 per cent. Each grain is about 2.5 mm. long and has a semi-transparent white colour. The starch grains resemble those of the oat, W. P. S.

**Changes in the Nitrogen in Soils.** F. LÖHNIS (*Centr. Bakt. Par.*, 1905, ii, 15, 361—365; from *Habilitationsschr. and Mitt. landw. Inst. Univ. Leipzig*, Heft 7, 1—103).—The decomposition of bone meal varies least according to the time of the year; nitrification, denitrification, and assimilation are more influenced, whilst the effect of season is most marked in the decomposition of urea and calcium cyanamide. Stubble has a distinct effect on denitrification and nitrogen assimilation, but not on the other changes. The effect of bringing the lower layers of soil to the surface was seen chiefly in diminished nitrification; the effect was less in the case of the decomposition of bone-meal and urea, and no effect was observed as regards nitrogen assimilation and the decomposition of calcium cyanamide.

The dryness in July was particularly injurious in connection with nitrification, nitrogen assimilation, and the decomposition of calcium cyanamide, but had practically no effect on denitrification and the decomposition of bone-meal and urea. For the uninterrupted continuance of the various changes in the soil, 60—80 per cent. of the water-holding capacity of the soil is required; for some changes 50 per cent. is too little. N. H. J. M.

**Transformations of Sodium Nitrate in the Soil of Sugar-beet Fields.** JULIUS STOKLASA (*Zeit. Zuckerind. Böhm.*, 1905, 30, 1—8).—It was formerly thought that, when used as a fertiliser, sodium nitrate is only absorbed in small quantity by the surface soil, and that the amount of this salt not assimilated by the roots of plants is washed through into the sub-soil. The author finds that this view is erroneous, and that the sodium nitrate is assimilated also by algae and bacteria, especially *Clostridium gelatinosum*, which are always present in soil in which sugar-beets have been cultivated, and which convert the nitrate into ammonia. The sub-soil never contains more than about half the amount of nitrogen present in the surface-soil in which the active bacteria are at work. The nitrogen of the nitrate is converted into organic and ammonia-nitrogen, the latter amounting to from 5 to 10 per cent. of the total nitrogen of the nitrate. T. H. P.

[**Manurial Experiments**] at Marburg. EMIL HASELHOFF (*Chem. Centr.*, 1905, ii, 1043—1045; from *Landw. Jahrb.*, 34, 597—664. Compare this vol., ii, 650).—Calcium cyanamide acts more injuriously on seeds in sand than in soil, and on mustard more than on clover. When, however, the injurious substances have been decomposed in the



soil, the effect of calcium cyanamide is similar to that of sodium nitrate.

Basic slag-ammonia is of no practical importance owing to losses when kept. In four weeks there was a loss of 20.9 per cent. of the total nitrogen.

The immediate effect of basic slag, or bone-meal, and kainite is increased by mixing the manures before applying them to the soil. The after effect is somewhat diminished, but the total effect, over two years, is greater when the manures are mixed than when applied separately.

N. H. J. M.

**Retrogression of Soluble Phosphates in Mixed Manures.** GEORGE GRAY (*Trans. Austral. Assoc. Sci.*, 1904, 157—161).—In a mixture of superphosphate and bone-dust, retrogression is slight and the citrate-soluble phosphoric acid increases at the expense of the insoluble phosphate. Bone-dust is the best form of tricalcium phosphate for mixing with superphosphate. Coral Queen guano reduced 7 per cent. of the soluble phosphoric acid in eighteen days. With Chesterfield guano, which contains much calcium carbonate (37.9 per cent.), retrogression was considerable, tricalcium phosphate being formed. Addition of basic slag resulted in 50 per cent. of the phosphoric acid being rendered insoluble in three hours, owing partly to the lime but more particularly to the oxides of iron. With slaked lime, retrogression was very rapid, and with ground limestone considerable. Kainite had only a slight effect, due chiefly to the magnesium salts,

N. H. J. M.

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## Analytical Chemistry.

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**A New Apparatus for Gas Analyses.** BERNHARD NEUMANN (*Chem. Zeit.*, 1905, 29, 1128).—A convenient (patented) portable apparatus for testing gases or their products of combustion in factories, &c.

For particulars, the original article and illustration should be consulted.

L. DE K.

**Improved Orsat Apparatus.** A. BEMENT (*J. Amer. Chem. Soc.*, 1905, 27, 1252—1255).—An improved Orsat apparatus is fully illustrated in the original. The chief distinguishing features are that the gas may be aspirated through the burette, and also that the pipette is so constructed that the absorbing reagent is sprayed or projected into the gas.

L. DE K.

**Improved Gooch Crucibles.** H. VOLLERS (*Chem. Zeit.*, 1905, 29, 1088).—The new crucible, made either of platinum or porcelain, has a cylindrical indentation in the bottom, the sides of which are perforated. These perforations run parallel with the plane of the actual bottom, so

that it is impossible for any particles of asbestos to be lost during the filtration.

L. DE K.

**Quick Method for the Valuation of Fluorspar.** A. W. GREGORY (*Chem. News*, 1905, 92, 184—185).—The carbon dioxide is estimated by the loss on ignition at a red heat of the dry fluorspar; the free silica by heating with hydrofluoric acid and the combined silica by heating with sulphuric acid and with hydrofluoric acid, the residue from the last treatment being converted into sulphate by the further action of sulphuric acid. This sulphate and also the fluoride from the second treatment are each weighed, and from these numbers and those for the carbon dioxide and total silica the amount of fluoride originally present is calculated.

D. A. L.

**Apparatus for Estimating Sulphur in Iron and Steel.** A. KLEINE (*Chem. Zeit.*, 1905, 29, 1129).—A slight modification of the apparatus previously described (*Abstr.*, 1903, ii, 694). The delivery tube dipping into the beaker or small Erlenmeyer flask containing the absorbent resembles a pipette, into the body of which has been placed a float. If regurgitation should take place, the float is pushed upwards by the inflowing liquid and so closes the orifice of the tube. The tube may be afterwards conveniently used as a stirring rod during the titration.

L. DE K.

**Some Uses of Iodic Acid in Volumetric Analysis.** TH. SCHUMACHER and E. FEDER (*Zeit. Nahr. Genussm.*, 1905, 10, 415—417).—Sulphurous acid may be estimated in foods, &c., by acidifying the latter with phosphoric acid and distilling in a current of carbon dioxide. The distillate is received in a flask containing potassium iodate solution and in connection with a second flask containing a little potassium iodide solution. The sulphur dioxide decomposes the iodate according to the equation:  $2\text{KIO}_3 + 5\text{SO}_2 + 4\text{H}_2\text{O} = \text{K}_2\text{SO}_4 + 4\text{H}_2\text{SO}_4 + \text{I}_2$ . After neutralising the sulphuric acid by the addition of calcium carbonate, the solution is titrated as usual with thiosulphate solution. If any iodine passes over into the second flask, the contents must not be mixed with the main distillate until after the calcium carbonate has been added.

Sodium thiosulphate solution may be standardised as follows: 0.1 gram of potassium iodate and 0.3 gram of potassium iodide are dissolved in 50 c.c. of water, 20 c.c. of *N*/10 sulphuric acid are then added, and the liberated iodine titrated with the thiosulphate solution.

To prepare *N*/10 iodine solution, 5 grams of potassium iodate and 25 grams of potassium iodide are dissolved in water. Exactly 100 c.c. of *N*/1 sulphuric acid are added and the mixture diluted to 1 litre.

W. P. S.

**An Improved Method for Estimating Nitrogen in Amino-acids.** VLADIMIR STANĚK (*Zeit. physiol. Chem.*, 1905, 46, 263—272).—The reaction described by Tilden between nitrosyl chloride and amino-acids may be used for quantitative purposes. The apparatus employed is described and figured, and examples are given of the exactitude of the method.

W. D. H.

**Estimation of Phosphoric Acid by means of Ammonium Phosphomolybdate.** II. GREGORY P. BAXTER and ROGER CASTLE GRIFFIN (*Amer. Chem. J.*, 1905, **34**, 204—217).—The conclusion arrived at in the previous paper (*Abstr.*, 1903, ii, 180), that it is possible to obtain a precipitate of constant composition and in a fit state for weighing, is confirmed. For the exact composition of the ammonium phosphomolybdate, the first paper should be consulted. It is essential that the phosphate solution should be added to the molybdate solution and not the reverse; otherwise the composition of the compound will be altered. The precipitation should take place in the cold, but if much potassium is present this replaces part of the ammonium in the precipitate; this, however, may be again replaced by ammonium on heating the precipitate with ammonium nitrate solution, thereby converting it into triammonium phosphomolybdate. According to the conditions of precipitation, ammonium phosphomolybdate occludes varying amounts of molybdic acid and ammonium molybdate. No method of estimating phosphoric acid is accurate unless notice is taken of such admixture.

The author further objects to Pemberton's titration of the yellow precipitate with standard potassium hydroxide, as the presence of ammonia affects the indicator phenolphthalein. Moreover, 24, not 23, mols. of alkali neutralise 1 mol. of ammonium phosphomolybdate.

L. DE K.

**A Rapid Volumetric Method for the Estimation of Phosphoric Acid.** W. B. HIRT and FRED W. STEEL (*Proc. Soc. Chem. Ind. Victoria*, 1905, 14—19).—*Total Phosphoric Acid.*—Two grams of the sample, charred if necessary, are heated with 5 c.c. of acid mixture (sulphuric acid, 250 c.c.; nitric acid, 150 c.c.; water, 100 c.c.) until sulphuric acid fumes are abundantly evolved. When cold, the mass is treated with about 150 c.c. of water and transferred to a 200 c.c. flask, 40 c.c. of alcohol are added, and the whole is made up to the mark. Twenty-five c.c. of the filtrate (0.25 gram sample) are then titrated as follows: the solution is neutralised first with normal sodium hydroxide, and towards the end with *N*/10 sodium hydroxide, using methyl-orange as indicator. Ten c.c. of absolutely neutral sodium citrate solution of sp. gr. 1.151 are added, and the titration is continued with a special sodium hydroxide solution (prepared by diluting 35.52 c.c. of normal sodium hydroxide to 1000 c.c.), using phenolphthalein as indicator. Each c.c. of this solution represents 1 per cent. of phosphoric anhydride.

*Phosphoric Acid Soluble in Water.*—Two grams are treated as usual on a filter with 200 c.c. of water. When about 50 c.c. have collected, 1 c.c. of 10 per cent. sulphuric acid is added to prevent phosphatic precipitation. Finally, 25 c.c. of the solution are titrated as directed.

*Phosphoric Acid Insoluble in Water and Ammonium Citrate.*—The residue left on treatment with water is treated with solution of neutral ammonium citrate of sp. gr. 1.09 and burnt to a white ash. This is then heated with 5 c.c. of an acid mixture (sulphuric acid, 60 c.c.; nitric acid, 100 c.c.; water, 140 c.c.) until sulphuric fumes appear. After making up to 100 c.c. with water, 25 c.c. of the



solution (0.5 gram) are titrated as above. The burette reading should be divided by 2, so as to indicate the percentage of phosphoric anhydride.

The process, which is a modification of that recommended by Littmann (Abstr., 1889, ii, 330), gives results fully agreeing with those obtained by the gravimetric methods.

L. DE K.

**Estimation of Arsenic as Magnesium Pyroarsenate.** JUAN FAGES VIRGILI (*Ann. Chim. Phys.*, 1905, [viii], 6, 394—407).—A résumé of work already published (compare this vol., ii, 652).

M. A. W.

**Detection and Estimation of Arsenic and Antimony in Presence of Organic Matter.** F. A. NORTON and A. E. KOCH (*J. Amer. Chem. Soc.*, 1905, 27, 1247—1252).—The process is based on the destruction of the organic matter by heating with sulphuric acid in a Kjeldahl flask. The residue contains the arsenic or antimony in the lower state of oxidation, and this may then be at once titrated with  $N/10$  iodine in the usual manner.

If the amount of arsenic or antimony is but small, a large quantity of the material must first undergo a preliminary treatment in the case of arsenic with nitric and sulphuric acids, or in the case of antimony with hydrochloric acid and potassium chlorate. A definite quantity of the solution thus obtained is then boiled in a Kjeldahl flask with sulphuric acid in order to destroy completely the last traces of organic matters.

Traces of arsenic are best estimated by the "mirror" method.

L. DE K.

**New Method for the Determination of Atmospheric Carbon Dioxide, based on the Rate of its Absorption by a Free Surface of a Solution of an Alkali Hydroxide.** HORACE T. BROWN and FERGUSON ESCOMBE (*Proc. Roy. Soc.*, 1905, B, 76, 112—117).—When a current of air containing a constant proportion of carbon dioxide is drawn over a free surface of a solution of sodium hydroxide, the rate of absorption increases with the velocity of the air current up to a certain speed, beyond which it remains constant. Further, the rate of absorption is proportional to the partial pressure of the carbon dioxide within fairly wide limits. On these facts, a method for estimating carbon dioxide in the atmosphere has been based, which has the advantage that it is unnecessary to measure the volume of air passed through the apparatus.

The air is aspirated through the apparatus at a rate greater than that required for maximum absorption and, by being passed through a perforated plate, is caused to impinge in a turbulent stream on the surface of a standardised solution of sodium hydroxide, which is titrated after the experiment. The constant of the apparatus having been determined once for all by a preliminary experiment in which the air is measured, the proportion of carbon dioxide in a sample of air can be calculated from the time during which the current has passed and the amount of gas absorbed, a correction being applied for the effect of change of temperature on the rate of absorption.

Samples of air containing 0.04 to 18 parts of carbon dioxide in 10,000 have been analysed by this method, and the results agree very satisfactorily with those obtained by the very accurate method of Reiset. G. S.

**A Simplified Method for the Estimation of Potassium.** FRIEDRICH KLINKERFUES (*Chem. Zeit.*, 1905, 29, 1085—1086).—Some further observations on the process previously described (this vol., ii, 204). The solution of the platinichloride need not always be evaporated to dryness with the formic acid in order to get a firm coating of platinum. Ammonium salts behave similarly. If both potassium and ammonium have to be estimated, the latter must be first expelled by boiling with water containing magnesium or sodium hydroxide and titrating the distillate. The residue in the flask may then be used for estimating the potassium in the way described. L. DE K.

**Use of the Rotating Anode and Mercury Cathode in Electro-analysis.** I. LILY G. KOLLOCK and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1905, 27, 1255—1269).—A lengthy paper dealing with the electrolytic deposition of zinc, copper, nickel, cobalt, chromium, and iron, fully illustrated by tables and curves. For working details, the original paper should be consulted.

The decomposition cell is a tube 3.5 cm. in diameter and 7.5 cm. in height made from a test-tube. The bottom of the tube is softened over the blow-pipe, and a platinum wire 2 cm. long is passed through, so that its end projects 0.5 cm. into the tube. The bottom is then flattened on an asbestos plate and annealed as usual. The anode, 7.5 cm. in length, is made from platinum wire 1 mm. in diameter coiled into a flat spiral 1.5 cm. in diameter. It is inserted in a chuck carried by the rotator, which is also provided with three pulleys varying from 2 to 5 cm. in diameter. These pulleys are connected by a belt to either of two pulleys on the motor. With this arrangement the rotation of the anode can be varied from 100 to 1800 revolutions per minute. During the experiment, an amperemeter, a voltmeter, and a rheostat allowing of resistance from 0.1—100 ohms are kept in the circuit. L. DE K.

**Use of the Rotating Cathode for the Estimation of Cadmium taken as the Sulphate.** CHARLES P. FLORA (*Amer. J. Sci.*, 1905, [iv], 20, 268—276).—Cadmium in solutions of the sulphate may, by the use of a rotating cathode, be estimated electrolytically when the solution contains excess of sulphuric acid, acetates, cyanides, pyrophosphates, phosphates, oxalates, urea, formates, or tartrates, and the conditions under which the best results were obtained are given in the paper (*Abstr.*, 1904, ii, 770). L. M. J.

**Electrolytic Estimation of Cadmium with the Use of a Rotating Anode.** ALICE L. DAVISON (*J. Amer. Chem. Soc.*, 1905, 27, 1275—1287).—A lengthy paper, fully illustrated with curves and tables, on the electrolytic precipitation of cadmium in presence of the following electrolytes: sulphuric acid, ammonia and ammonium sul-

phate, sodium formate, ammonium formate, sodium acetate, ammonium acetate, potassium cyanide in presence of sodium hydroxide, ammonium succinate, sodium succinate. Ammonium lactate or sodium lactate cannot be recommended.

Processes are also given for the separation of cadmium from magnesium, iron, nickel, and cobalt. For working details, the original paper should be consulted.

L. DE K.

**Rapid Electrolytic Estimation of Lead.** RALPH O. SMITH (*J. Amer. Chem. Soc.*, 1905, 27, 1287—1293).—Twenty-five c.c. of lead nitrate solution containing not more than 0.25 gram of metal are mixed with 20 c.c. of nitric acid of sp. gr. 1.4 and diluted with water to 115 c.c. The solution is then subjected to electrolysis, using a rotating electrode (in this case the cathode) making about 450 revolutions per minute.

The following conditions are necessary to ensure success: temperature, 70°; time, at least 15 minutes; volts, 3.7—4.0; amperes,  $ND_{100}$  11—13.

The lead separates as dioxide, which is first washed with water without interrupting the current, and then with alcohol and ether. It is dried for at least half an hour at 200—230°. In calculating the lead, the factor 0.8643 should be employed if the weight of the precipitate exceeds 0.1 gram.

L. DE K.

**Volumetric Methods for Estimating Copper.** GUSTAVE FERNEKES and ARTHUR A. KOCH (*J. Amer. Chem. Soc.*, 1905, 27, 1224—1240).—A criticism of the various volumetric processes for the estimation of copper, including the cyanide process and its modifications, the ferrocyanide method, the thiocyanate method, the acidimetric method, the permanganate method, and the iodometric method, which the authors consider to be the most suitable for ores.

The solution of the copper ore obtained in due course is treated with a strip of aluminium, the precipitated copper is washed, redissolved in nitric acid, and boiled. The solution is diluted, rendered alkaline with ammonia, again boiled, and then acidified with acetic acid. When cold, 3 grams of potassium iodide are added, and the liberated iodine is titrated with  $N/10$  sodium thiosulphate.

L. DE K.

**Electrolytic Estimation of Mercury [in Cinnabar] with the Use of a Rotating Anode.** RALPH O. SMITH (*J. Amer. Chem. Soc.*, 1905, 27, 1270—1275).—About 0.5 gram of the ore is repeatedly boiled with solution of sodium sulphide of sp. gr. 1.06. About 60 c.c. in all will be required for complete extraction. The united filtrates are then subjected to electrolysis, using a rotating anode. The conditions essential to success are: time, not less than 20 minutes; volts, 6—5.1; amperes,  $ND_{100}$  6. The results compare favourably with the usual combustion with lime. The process also applies to other mercury salts.

L. DE K.

**Occurrence of Alumina in Plants.** HENRI PELLET and CH. FRIBOURG (*Ann. Chim. anal.*, 1905, 10, 373—376).—The authors have



examined sugar-cane and beetroots for alumina, and find that the latter is present in the ashes of the plants in only very minute quantity. The method employed for the estimation of the alumina in the plant-ash was as follows: after separation of the silica, the hydrochloric acid solution was nearly neutralised with ammonia and oxidised by the addition of a few crystals of potassium chlorate. Two grams of ammonium phosphate and 10 grams of ammonium thiosulphate were then added and the mixture boiled for fifteen minutes, 15 grams of acetic acid being afterwards added. The precipitate of aluminium phosphate was collected on a filter, ignited, and weighed. W. P. S.

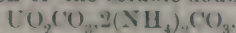
**Detection of Nickel [in Presence of Cobalt].** STANLEY R. BENEDICT (*J. Amer. Chem. Soc.*, 1905, 27, 1360—1361).—The neutralised solution is saturated with potassium chloride and a little solid potassium nitrite, or 1 c.c. of its saturated solution, is added. The mixture is then acidified with acetic acid and shaken for half a minute. The cobalt is completely precipitated, and although some of the nickel is also deposited, sufficient remains in solution and may be precipitated with ammonium sulphide and then further identified by the bead test. L. DE K.

**The Sodium Hydroxide Method of Estimating Molybdenum in Steel.** GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1905, 27, 1240—1246).—A reply to Cruser and Miller (*Abstr.*, 1904, ii, 593), who state that iron also goes into solution to some extent, and that, therefore, the separation of molybdic acid from iron oxide by means of sodium hydroxide is untrustworthy.

The author states that the small quantity of iron found in their experiments has most likely passed through mechanically. When carried out in the following manner, the process gives technically accurate results.

0.8 gram of the steel is dissolved in nitric acid, evaporated to dryness, boiled with 25 c.c. of hydrochloric acid, and evaporated with 10 c.c. of dilute sulphuric acid (3:1) until fumes appear. Fifty c.c. of water are added, and the solution is poured gradually into 100 c.c. of the alkali hydroxide (454 grams sodium hydroxide + 2100 c.c. water). After diluting to 200 c.c., 100 c.c. of the filtrate are acidified with 15 c.c. of sulphuric acid, reduced with zinc, and titrated with permanganate. L. DE K.

**Properties of Ammonium Uranate.** FEDERICO GIOLITTI (*Gazzetta*, 1905, 35, ii, 145—150. Compare *Abstr.*, 1904, ii, 783).—The principal errors in the estimation of uranium by precipitation as ammonium uranate from solutions of uranyl salts consist in (1) the formation of colloidal ammonium uranate, which may be prevented, not by large quantities of ammonia as Rose recommended, but by ammonium salts, especially the chloride; (2) a loss of uranium owing to the absorption of carbon dioxide from the air by ammonia solutions and subsequent formation of the soluble double salt,



The author consequently adopts the following method of working:

300 to 400 c.c. of solution containing 0.1—0.2 gram of uranium in the form of uranyl salt and about 1 gram of ammonium chloride are heated to boiling in a platinum or porcelain basin. The boiling is stopped, and the solution kept well stirred while ammonia solution (one part concentrated solution mixed with ten parts of water) is gradually added until the liquid smells distinctly of it. The precipitated ammonium uranate is washed by decantation several times with boiling 0.2—0.5 per cent. ammonium chloride solution, separated by filtration, and again washed with the same solution. It is then converted either into  $U_3O_8$  by ignition in air or into  $UO_2$  by ignition in a stream of hydrogen, the heating being gentle until the ammonium chloride has been expelled.

T. H. P.

### Estimation of Titanic Acid in Soils and Ashes of Plants.

HENRI PELLET and C. FRIBOURG (*Chem. Centr.*, 1905, ii, 1193—1194; from *Bull. Assoc. Chim. Sucre Dist.*, 23, 67—71).—*Colorimetric Process.*—0.5 gram of finely-powdered dry soil or 2.5 grams of plant-ash are put into a platinum crucible containing 15 grams of pure hydrofluoric acid, 1 c.c. of sulphuric acid is added, and the whole is evaporated to dryness. The residue is then fused with 5 grams of potassium hydrogen sulphate, and the mass is dissolved in 15 per cent. sulphuric acid at a temperature not exceeding 60°. When cold, the liquid is made up to 100 c.c., and 10 c.c. are mixed with 5 c.c. of hydrogen peroxide. The colour generated is then compared as usual with that obtained by means of a known amount of titanium. If much titanium is present, the solution must be diluted suitably.

*Gravimetric Methods.*—If soils contain at least 2 per cent. of titanium dioxide, 3 grams of the sample are evaporated with 30 grams of hydrofluoric acid and 3 grams of sulphuric acid, and the residue is fused with 15 grams of potassium hydrogen sulphate. The mass is then heated at 60° with 200—250 c.c. of water, diluted to 300 c.c., and filtered. Forty c.c. of the filtrate are then titrated with aqueous potassium hydroxide, 10 c.c. of which represent 5 grams of potassium hydrogen sulphate. To 250 c.c. of the filtrate is then added so much alkali that there still remains 5 grams of free potassium hydrogen sulphate, the liquid is boiled for two hours with addition of dilute sulphurous acid of sp. gr. 1020—1025, added in three portions of 50 c.c. each. The precipitate is collected and ignited, and then fused with 2 grams of potassium carbonate; the mass is treated with boiling water, and the titanate formed washed with a 2 per cent. solution of potassium carbonate. A small portion, however, passes into solution and should be estimated separately. The titanate is now fused with 1 gram of potassium hydrogen sulphate and the titanic acid separated in the manner described.

When dealing with soils containing less than 1 per cent. of titanium dioxide, twice 5 grams of the ignited soil are fused with 10 grams of potassium carbonate and 10 grams of sodium carbonate; the mass is evaporated with hydrochloric acid, the silicic acid is expelled by evaporation with hydrofluoric and sulphuric acids, and to the residue is added the ignited precipitate formed by ammonia in the

hydrochloric acid solution. The whole is then fused with 15—20 grams of potassium hydrogen sulphate and treated as directed.

Of ashes which contain less than 0.2 per cent. of titanium dioxide, 50 grams are taken, and the silica separated therefrom is treated first with hydrofluoric and sulphuric acids, and the residue is then treated several times with potassium carbonate, potassium hydrogen sulphate, &c., as directed, until a pure titanium dioxide is obtained. To the filtrate from the silica are added 0.5 gram of sublimed ferric chloride and 25 grams of ammonium phosphate; the mixture is evaporated in a platinum dish and the residue ignited to expel ammonium salts. The mass is then digested in dilute hydrochloric acid and the residue submitted to fusion with potassium carbonate and finally with potassium hydrogen sulphate as described.

L. DE K.

**Zirconium Oxychloride as a means of Testing for Zirconium.** RUDOLF RUER (*Zeit. anorg. Chem.*, 1905, 46, 456—459).—The formation of zirconium oxychloride,  $\text{ZrOCl}_2 \cdot 8\text{H}_2\text{O}$ , is recommended as a means of detecting the presence of zirconium. The precipitate obtained from the experimental material by means of ammonia is separated from the filter-paper and dissolved in hydrochloric acid. The solution is evaporated to dryness on the water-bath and then dissolved in a little water. Concentrated hydrochloric acid is added drop by drop so as to obtain a precipitate of the oxychloride; this precipitate goes into solution on warming the liquid, and on cooling separates again in crystals which have a characteristic appearance (thin prisms) under the microscope.

Hauser's statements as to the properties of zirconium compounds (this vol., ii, 531) are criticised.

D. H. J.

**Heating of Mineral Oils when shaken with Concentrated Sulphuric Acid.** RICHARD KISSLING (*Chem. Zeit.*, 1905, 29, 1086).—Seventy-five c.c. of the sample are introduced through a side opening into a cylindrical vessel of special construction, and 25 c.c. of sulphuric acid are then very carefully allowed to run from a pipette to the elongated bottom of the instrument. The cylinder is conveniently furnished with taps at both ends, but these are not absolutely necessary. After inserting the thermometer and placing the instrument in a wooden casing, the thermometer is read after its indication has become constant, and the whole is then shaken until the temperature no longer rises but begins to fall.

A number of experiments with various mineral and lubricating mineral oils are recorded.

L. DE K.

**Apparatus for determining the Melting Point of Asphalt.** HUGO BAUER (*Chem. Rev. Fett Harz-Ind.*, 1905, 12, 258—260). A modification of the Kraemer Sarnow apparatus is described. A test-tube, 4 cm. in diameter and about 15 cm. long, is hung in the neck of a flask so that its lower end is immersed in the water (or other liquid) placed in the flask. The test-tube is closed by a cork through which three holes have been bored; the centre hole is for the



thermometer and the other two for the testing cylinders. The latter consist of open tubes 7 mm. in diameter and 15 cm. long. A mark is placed on the tubes 5 mm. from the lower end, and a second mark above it at such a distance that the space between the marks will hold exactly 5 grams of mercury. Each tube is also provided with a closely-fitting piston attached to a rod reaching above the upper end of the tube. The tubes are filled as follows: the piston is pushed in until its lower end is at the upper mark on the tube: the tube is then inverted, mercury poured in to fill the space between the marks, and finally the melted asphalt. After cooling, the asphalt is trimmed with a knife level with the end of the tube and the latter inserted through the hole in the cork of the test-tube. The second tube may be filled with another sample or serve as a duplicate. The melting point is then determined as in the original method.

W. P. S.

**Examination of *o*-Nitrotoluene for the Presence of Small Quantities of *p*-Nitrotoluene.** ARNOLD F. HOLLEMAN and COENRAAD L. JUNGUS (*Chem. Centr.*, 1905, ii, 988—989; from *Chem. Weekblad*, 2, 553—554. Compare this vol., i, 272).—The presence of 0.4 per cent. of *p*-nitrotoluene in a sample of *o*-nitrotoluene which had been obtained by Meister, Lucius, & Brünig's method (this vol., i, 639) was inferred from the fact that the crystals from the mother liquor of the acetyl derivative of the toluidine prepared from the sample melted at a temperature one degree lower than that of the pure compound.

E. W. W.

**Amount of Sodium Salts naturally occurring in Wine.** OTO KRUG (*Zeit. Nahr. Genussm.*, 1905, 10, 417—421).—From the results of the analyses of forty-eight samples of wine it is seen that the total amount of sodium oxide ( $\text{Na}_2\text{O}$ ) varies from 0.0004 to 0.0060 per cent. Even where the vines had been partially manured with sodium nitrate (Chili saltpetre), the latter figure was not exceeded. In thirty-eight of the above-mentioned samples, the sodium oxide was not more than 1 per cent. of the total ash. There is but little difference between red and white wines in this respect. The author therefore concludes that any German wine containing more than 0.010 per cent. of sodium oxide has been artificially prepared.

W. P. S.

**Detection of Asaprol [ $\beta$ -Naphtholsulphonate]; Estimation of Methyl Alcohol in Presence of Formaldehyde.** HENRY LEFFMANN (*Chem. Zeit.*, 1905, 29, 1086).—A mercurial reagent is prepared by dissolving mercury in twice its weight of nitric acid and diluting the solution with five times its bulk of water. In order to detect the preservative asaprol [ $\beta$ -naphtholsulphonate] in milk, 10 c.c. of the sample are mixed with 0.5 c.c. of the reagent, which will cause a yellow coloration should asaprol be present. To detect the same in wine or fruit juices, 25 c.c. of the sample are acidified with sulphuric acid and shaken with an equal volume of ether, light petroleum, chloroform, or carbon tetrachloride; the author prefers light petroleum. The solution is then shaken with addition of a few drops of the reagent, and in

presence of asaprol the mercury solution soon turns yellow and then red. Benzoates and salicylates give no reaction.

Methyl (also ethyl) alcohol may be completely freed from formaldehyde by distilling the mixture with a slight excess of potassium cyanide. It is advisable to test a little of the mixture for possible traces of undecomposed formaldehyde by the phenylhydrazine-nitroprusside reaction. The distillate is now tested for methyl alcohol by the well-known red hot copper (formalin) test.

L. DE K.

**Estimation of Glycerol in Soap-lyes.** H. STRAUSS (*Chem. Zeit.*, 1905, 29, 1099—1100).—From 10 to 30 grams of the sample are introduced into a 100 c.c. flask and a slight excess of basic lead acetate is added. In the presence of much salt it is as well to add first 1 gram of silver oxide suspended in water. The whole is diluted to 100 c.c. and 10 c.c. of the filtrate are used for the analysis; 5—6 grams of powdered potassium dichromate are put into a 250 c.c. distilling flask and the glycerol solution is introduced through a separating funnel, followed by 20 c.c. of water and then by 20 c.c. of dilute sulphuric acid (1:2). The flask is connected with a short reflux condenser in order to condense most of the steam. The whole is boiled for twenty minutes, whilst air, which has passed through a Drexel wash-bottle containing potassium hydroxide solution, is drawn through by means of an aspirator. The carbon dioxide formed by the oxidation of the glycerol is first passed through a series of five calcium chloride tubes and then absorbed in the usual weighed potash apparatus. After passing the current of air for another twenty minutes, the potash apparatus is reweighed. The increase in weight  $\times 0.6976 =$  glycerol in the 10 c.c. taken.

L. DE K.

**Spectroscopic and Colour Reactions of Important Sugars.** ERW. PINOFF (*Ber.*, 1905, 38, 3308—3318. Compare this vol. ii, 289).—The following sugars have been investigated: arabinose, rhamnose, dextrose, mannose, galactose, levulose, sorbose, sucrose, lactose, maltose, raffinose. All these, with the exception of arabinose, give the Molisch reaction when 0.05 gram is mixed with 10 c.c. of a sulphuric acid-alcohol mixture and 0.2 c.c. of a 5 per cent. alcoholic solution of  $\alpha$ -naphthol. Considerable differences are noticed as regards length of time of heating required. When similar experiments are made with the addition of 10 c.c. of ethyl alcohol, only levulose, sorbose, sucrose, and raffinose give the reaction, each yielding a single band at  $5088 \mu\mu$ . With the more concentrated solution, each of these sugars gives two bands at 5736 and 5088, whereas the other sugars give a single band at 5325.

Similar experiments have been made with  $\beta$ -naphthol. With the more dilute solution, levulose gives a reddish-brown, and sorbose a yellowish-green, coloration after twenty-five minutes at  $95-98^\circ$ ; the remaining sugars give no reaction even after forty-five minutes. With the more concentrated solution, levulose, sorbose, sucrose, and raffinose react after four minutes, yielding solutions with an absorption band at  $5050 \mu\mu$ .

Experiments with resorcinol, using 5 c.c. of alcohol, 5 c.c. of the alcohol-acid mixture, and 0.2 c.c. of a 5 per cent. resorcinol solution,

show that all give a band at 4875 with the exception of arabinose, rhamnose, mannose, and galactose. The band is given most readily by lævulose, sorbose, sucrose, and raffinose.

All the sugars yield a yellow precipitate when heated for twenty minutes with 10 c.c. of a 10 per cent. ferric chloride solution. They also, with the exception of sucrose and raffinose, reduce potassium ferrocyanide and ferricyanide and lead acetate. Only sorbose and lævulose yield precipitates when heated with equal quantities of 5 per cent. solutions of potassium dichromate and ammonium chloride; the precipitate is formed after twelve minutes with sorbose and after twenty with lævulose.

Lævulose yields a characteristic blue coloration when 0.1 gram is heated for three minutes with 10 c.c. water, 10 c.c. of 4 per cent. ammonium molybdate solution, and 0.2 c.c. of glacial acetic acid. Arabinose, rhamnose, galactose, mannose, and sorbose give a green coloration only after some thirty minutes. Mineral acids must not be present in testing for lævulose by this method, as most sugars in the presence of mineral acid give a blue coloration with ammonium molybdate.

J. J. S.

**Diphenylhydrazine as a Reagent for Lactose.** W. C. DE GRAAFF (*Chem. Centr.*, 1905, ii, 991; from *Pharm. Weekblad*, 42, 685—686).—When a drop of diphenylhydrazine and 2—3 drops of glacial acetic acid are boiled with a few mg. of lactose, the brownish-violet coloration which is first formed becomes successively yellow and brownish-red, and the viscosity of the solution increases. When the mixture is further heated, it becomes blackish-green and finally brown. If the green solution is treated with a few c.c. of 70 per cent. alcohol, a characteristic green liquid is obtained. The green dye is also soluble in amyl alcohol, chloroform, and ether, but insoluble in water or carbon disulphide. Arabinose, lævulose, dextrose, galactose, mannose, sucrose, maltose, melibiose, dextrin, amyllum, and gum arabic only form deep reddish-brown colorations with diphenylhydrazine. This reaction may be used to detect lactose in mixtures of equal parts of lactose, dextrose, and sucrose, and in mixtures of sucrose with 10 per cent. of lactose.

E. W. W.

**Separation of Starch Coagulum and Amylocellulose.** JULES WOLFF (*Ann. Chim. anal.*, 1905, 10, 389—392).—The principle of the method described is as follows: equal weights of the starch are placed in three flasks and converted into a paste by heating under pressure with water. After cooling, the contents of one of the flasks (*a*) receives the addition of 20.5 c.c. of a 10 per cent. malt infusion. The other two flasks (*b* and *c*) receive 0.5 c.c. of the same infusion. The flask *a* is kept at a temperature of 60°; the contents of flask *b* are allowed to coagulate at the ordinary temperature for three hours, 20 c.c. of the *boiled* malt infusion are then added and the volume made up to 200 c.c., whilst the contents of flask *c*, after being allowed to coagulate as in the case of flask *b*, are treated with 20 c.c. of the malt infusion (*not boiled*) and saccharified at a temperature of 70° before diluting to 200 c.c. At the end of three hours, the contents of flask *a* are also made up to 200 c.c. All three solutions are then filtered and



100 c.c. of each of the filtrates heated in an autoclave at a temperature of  $120^{\circ}$  for twenty minutes, and the reducing power of each estimated and calculated into starch. The difference between *a* and *b* gives the weight of the coagulum, and the difference between *a* and *c* that of the amylocellulose.

W. P. S.

**Estimation of Formaldehyde.** CARL GOLDSCHMIDT (*J. pr. Chem.*, 1905, [ii], 72, 343—344. Compare Abstr., 1903, i, 82).—A résumé of some methods which have been proposed for the estimation of formaldehyde (compare Legler, Abstr., 1883, 1035; 1889, 579; Trillat, Abstr., 1893, ii, 439; Grützner, Abstr., 1897, ii, 166; Romijn, *ibid.*).

G. Y.

**Estimation of Certain Aldehydes and Ketones in Essential Oils.** SAMUEL S. SADTLER (*J. Amer. Chem. Soc.*, 1905, 27, 1321—1327).—Further details of and experiments on the process already published (Abstr., 1904, ii, 372). Contrary to the statement of Burgess (Abstr., 1904, ii, 371), the author finds that carvone reacts not only with one but with two mols. of sulphite, and that citronellol does not react.

L. DE K.

**Toxicological Detection of Hydrocyanic Acid.** DOMENICO GANASSINI (*Chem. Centr.*, 1905, ii, 1036—1037; from *Boll. Chim. Farm.*, 44, 519—525. Compare Abstr., 1904, ii, 758).—An account of the different distribution of hydrocyanic acid in the blood and organs of the body after it has been administered in various ways. The number of instances where it is not found indicates that it is completely changed in the animal body.

W. D. H.

**Evaluation of Official Mercuric Cyanide.** ERWIN RUPP (*Arch. Pharm.*, 1905, 243, 468—469).—One gram of the sample is dissolved in water and made up to 100 c.c.; 10 c.c. of the solution are mixed with a little water and 10—20 c.c. of approximately *N*-potassium hydroxide solution in a 200 c.c. stoppered flask; 25 c.c. of *N*/10 iodine solution are added with gentle agitation, and the mixture is allowed to remain for about two hours at the ordinary temperature, or for 20—30 minutes on the water-bath. The liquid is then diluted with water to about 100 c.c. and acidified with dilute hydrochloric acid, and the iodine liberated is titrated after 1—2 minutes with *N*/10 thiosulphate solution. In the case of a pure sample, 15.87 c.c. of *N*/10 iodine solution should be used up in oxidising the cyanide to cyanate; consequently the volume of *N*/10 thiosulphate solution required should be 9.3—9.1 c.c., corresponding with a purity of 99—100 per cent.

C. F. B.

**Titrimetric Estimation and Separation of Cyanides, Thiocyanates, and Chlorides.** ERWIN RUPP (*Arch. Pharm.*, 1905, 243, 458—467).—A known quantity of the cyanide dissolved in 10 c.c. of water is mixed with 10 c.c. of approximately *N*-potassium hydroxide solution in a stoppered bottle, 25 c.c. (representing a considerable excess) of *N*/10 iodine solution is added with gentle agitation, and the

whole is then allowed to remain for three hours at the ordinary temperature, or for thirty minutes on the water-bath, when the cyanide becomes oxidised to cyanate. Finally, the contents of the bottle are diluted to about 100 c.c. and acidified with dilute hydrochloric acid, and the iodine liberated is titrated with  $N/10$  thiosulphate solution. Each 1 c.c. of  $N/10$  iodine solution oxidises 0.0013 gram of cyanogen.

A known quantity of thiocyanate dissolved in 10 c.c. of water is mixed with 10—20 c.c. of approximately  $N$ -potassium hydroxide solution, 25 c.c. (a considerable excess) of  $N/10$  iodine solution are added, and the whole is allowed to remain for four hours at the ordinary temperature or thirty minutes on the water-bath; it is then cooled, acidified with dilute hydrochloric acid, and titrated with  $N/10$  thiosulphate solution. The thiocyanate is oxidised to sulphuric acid and cyanate, every 1 c.c. of  $1/10$  iodine solution oxidising 0.000725 gram of thiocyanogen (CNS).

For the estimation of a mixture of cyanide and thiocyanate, a known quantity of the mixture is allowed to remain for four hours with excess of  $N/10$  iodine solution and about 2 grams of sodium hydrogen carbonate; the cyanide is converted into cyanogen iodide and the thiocyanate into sulphuric acid and cyanogen iodide. The mixture is then acidified cautiously with hydrochloric acid, when iodine is regenerated from the cyanogen iodide, only that which has oxidised the sulphur of the thiocyanate to sulphuric acid remaining permanently as iodide. Finally, the iodine liberated is titrated with  $N/10$  thiosulphate solution. Each 1 c.c. of  $N/10$  iodine solution used corresponds with 0.000967 gram of CNS. The total amount of cyanide and thiocyanate together is estimated by oxidation in the presence of potassium hydroxide as described above.

In a mixture of cyanide, thiocyanate, and chloride, first the thiocyanate, and then the thiocyanate and cyanide together, are determined as just described; finally, all three are determined together by adding a known quantity of the mixture to excess of  $N/10$  silver solution in a 100—200 c.c. graduated flask, diluting to the mark, filtering, mixing a measured volume of the filtrate with plenty of nitric acid and about 5 c.c. of iron alum solution (1 : 10), and titrating the excess of silver with  $N/10$  thiocyanate solution.

In none of the experiments quoted did the experimental error quite reach 1 per cent. of the quantity estimated. C. F. B.

**Lead Malate and Barium Citrate.** T. C. N. BROEKSMIT (*Chem. Centr.*, 1905, ii, 886—887; from *Pharm. Weekblad*, 42, 637—640. Compare Abstr., 1904, ii, 688).—Citric acid and malic acid give the iodoform reaction. Pure malic acid is prepared by treating an aqueous solution of the acid with lead acetate and decomposing the lead malate with sulphuric acid. In order to detect citric acid in the presence of malic acid, the solution is treated with barium chloride and ammonia, and the insoluble barium citrate tested with potassium permanganate, ammonia, and iodine for the iodoform reaction.

E. W. W.

**Detection of Pyrrolidine-2-carboxylic Acid.** D. ALEXANDROFF (*Zeit. physiol. Chem.*, 1905, 46, 17—18).—This substance in either the active or racemic state may be detected by means of its picrate. The characters, solubilities, &c., of the two picrates are described; that from the racemic form melts at 135—137°; that from the active at 153—154°.

W. D. H.

**Composition and Analysis of Milk.** H. DROOP RICHMOND (*Analyst*, 1905, 30, 325—329).—The average composition of 15,910 samples of milk analysed during the year 1904 is given. The average amount of fat was 3.74 per cent., being a little less than that found in 1903 (*Abstr.*, 1904, ii, 522).

A number of experiments was carried out with a view to ascertaining the correct volume of the divisions of the necks of the bottles used in Gerber's method. Each division should have a volume of 0.126 c.c., and will then indicate 1 per cent. of fat. The exact diameter of the neck is of no importance. The volume of the fat obtained in the Gerber method is about 1.025 the volume of the fat in the milk. Neglect of the volume of the fat between the upper and the lower parts of the meniscus is partly compensated by the decrease in weight of the milk delivered by an 11 c.c. pipette with increasing quantities of fat.

The results of a sample of human milk are given: total solids, 10.39 per cent.; fat, 1.98 per cent.; sugars, 6.40 per cent.; proteids, 1.75 per cent.; ash, 0.26 per cent. The amount of fat in this sample is much below the average.

W. P. S.

**Occurrence in Milk Serum of Substances which react with Naphthalene- $\beta$ -sulphonic Chloride.** ROBERT STRITTER (*Milchw. Zentr.*, 1905, 1, 444—447).—Milk serum obtained by precipitating the proteids of fresh milk with an acid alcoholic solution of tannin, removing the excess of tannin with lead acetate and the latter with hydrogen sulphide, gave a residue on evaporation which contained no substances soluble in alcohol-ether. The absence of hippuric acid in normal fresh milk was thus proved. The serum was then rendered alkaline and shaken for many hours with an ethereal solution of naphthalene- $\beta$ -sulphonic chloride. After separating the ether, the aqueous portion was acidified with hydrochloric acid and extracted with ether, ammonium sulphate being also added to "salt out" the amino-acid compounds. In no case could the presence of an amino-compound or other substance reacting with the naphthalene- $\beta$ -sulphonic chloride be detected in normal fresh milk. An extremely minute quantity, however, of a nitrogenous substance was obtained, the identity of which was not established.

W. P. S.

**Estimation of Fat and Water in Butter by Gerber's Method.** A. HESSE (*Milchw. Zentr.*, 1905, 1, 433—444).—The two pieces of apparatus constructed by Gerber, one for the estimation of water in butter and the other for the combined estimation of water and fat in the same article of food, are both shown to give untrustworthy results. The latter neither agree between themselves nor with the quantities



found by the ordinary gravimetric method. The author therefore concludes that both pieces of apparatus are useless for estimating water and fat in butter.

W. P. S.

**Testing Lard and Butter.** \*EDUARD POLENSKE (*Chem. Centr.*, 1905, ii, 1130—1132; from *Arbb. Kais. Ges. A.*, 22, 557—575).—A criticism of the various methods in use for the testing of lard. Halphen's sulphur test, although extremely delicate, should not be taken without confirmation as a proof of the presence of cotton-seed oil, as the active principle of this oil which causes the reaction passes into the lard when the pigs are fed on cotton-seed cake. In such case, the phytosterol or the phytosterol acetate test should be applied. All adulterated lards yield an acetate-mixture the melting point of which exceeds 117°.

The phytosterol acetate test may also be successfully applied for ascertaining the purity of butter. As little as 7·5 per cent. of margarine or vegetable fats may be identified.

L. DE K.

**Lard Testing.** EDUARD POLENSKE (*Chem. Centr.*, 1905, ii, 1132; from *Arbb. Kais. Ges. A.*, 22, 576—583).—To detect small quantities of paraffin in lard, the unsaponifiable matter obtained from 100 grams of the sample is heated with 5 c.c. of sulphuric acid in a cylinder glass placed in a glycerol-water bath at 104—105° for an hour. When cold, the residue is shaken three times with 10 c.c. of light petroleum of low boiling point, the solution is repeatedly washed with water (to the second washing a little barium chloride is added) and then filtered and evaporated in a tared dish. Pure lard free from paraffin will yield about 0·003 gram of resinous residue.

When the unsaponifiable matter, or crude cholesterol, is intended for the phytosterol acetate test, it must be first freed from any paraffin by washing with light petroleum. This also removes undesirable resinous matters and leaves a residue richer in phytosterol.

L. DE K.

**Detection of Coconut Oil in Lard.** L. HOTOX (*Chem. Centr.*, 1905, ii, 1195; from *Rev. intern. falsific.*, 18, 85—86).—Five grams of the sample are heated with 10 c.c. of acetic acid of sp. gr. 1·055 at 60° and well shaken. When cooled to 40°, the bottom layer is transferred to a flat dish. The operation is repeated and the bottom layer is collected in a second and the top layer in a third dish. After driving off the acetic acid by heating for 30—40 minutes at 70—80°, the three portions are examined in the Abbé-Zeiss refractometer at 40°. In the case of pure lard, the three fractions will show a decreasing refraction, such as 50·5—49·7—49·3°, whilst with pure coconut oil an increasing refraction is obtained, 34·2—35—35·6°. In a mixture containing 15 per cent. of the latter, the refraction of the first shaking is lower than that of the residue 46·0—46·6—48·3°, therefore the reverse of what is noticed with pure lard.

L. DE K.

**Estimation of Cyanamide and its Applications.** RENATO PEROTTI (*Gazzetta*, 1905, 35, ii, 228—232. Compare this vol., ii, 196, 278).—The method given for the estimation of cyanamide is

based on the reaction occurring with silver nitrate in presence of ammonia, by means of which insoluble silver cyanamide is precipitated according to the equation:  $\text{CN}\cdot\text{NH}_2 + 2\text{AgNO}_3 = \text{Ag}_2\text{CN}_2 + 2\text{HNO}_3$ . The cyanamide solution is run from a burette into a definite volume of  $N/100$  silver nitrate solution, rendered distinctly but not excessively ammoniacal, an excess of silver nitrate being left in the liquid. The precipitate is coagulated by gentle heating and removed by filtration, the silver in the filtrate being then estimated by titration with  $N/100$  ammonium thiocyanate.

This method may be applied to the estimation of the calcium cyanamide in the artificial manure known as "kalkstickstoff," 1 c.c. of centinormal silver nitrate solution corresponding with 0.0004 gram of calcium cyanamide.

T. H. P.

**Estimation of Acetanilide.** WILLIAM A. PUCKNER (*Pharm. Rev.*, 1905, 23, 302—304).—Acetanilide and caffeine may be estimated in headache remedies by shaking out an acidified solution with chloroform, evaporating the latter, and weighing the residue, the caffeine being subsequently precipitated as the periodide. A number of experiments are described in which it was found that acetanilide may be volatilised during the evaporation of the chloroform solution unless special precautions are taken. Acetanilide is volatile at a comparatively low temperature. If the solvent be distilled from a flask and the residue dried below  $60^\circ$ , the loss is slight, and a constant weight is obtained after twenty-four hours. The residue obtained from an ether or chloroform solution of acetanilide is not pure acetanilide, but fairly trustworthy results may be obtained if, after the solvent has been distilled off, the flask is rotated until crystallisation sets in and the residue then dried at  $95^\circ$  for two hours. W. P. S.

**Volumetric Estimation of Pyramidone and Antipyrine in the Presence of each other.** GASTON PÉGUIER (*Ann. Chim. anal.*, 1905, 10, 392—393).—The picric acid method for the estimation of pyramidone alone (*Abstr.*, 1905, ii, 778) must be slightly modified if antipyrine is also present. The two substances are first precipitated together, as previously described, and the percentage weight of the precipitate obtained. This weight may be termed  $P$ . A second quantity of 0.231 gram of the sample is then dissolved in 10 c.c. of water, and the alkalinity of the pyramidone exactly neutralised with  $N/10$  sulphuric acid, using helianthin as indicator. Forty grams of  $N/20$  picric acid solution are now added, and the solution is titrated with  $N/10$  potassium hydroxide solution after the addition of a little phenolphthalein. A second value is thus obtained,  $P'$ . Then  $P - P'$  is the percentage of pyramidone in the sample, and by subtracting the value  $P$  from the pyramidone the percentage of antipyrine is obtained.

W. P. S.

**Alkaloid Reactions.** Veratrine (puriss. German Pharm-acopœia IV). C. REICHARD (*Chem. Centr.*, 1905, ii, 857—858; from *Pharm Centr.*, H., 46, 644—649. Compare *Abstr.*, 1904, ii, 847; this vol, ii, 68, 127, 561, and 563).—When a small quantity of veratrine is

added to a crystal of potassium ferricyanide and water, the mixture evaporated, and the residue treated with a drop of a 25 per cent. solution of hydrochloric acid, a green coloration is formed, but if potassium ferrocyanide is used instead of potassium ferricyanide a snow-white mass is obtained. Other more or less characteristic tests with ammonium molybdate, ammonium metavanadate, mercurous nitrate, sodium iodate, potassium dichromate, tungstic acid, bismuth chloride, copper sulphate, copper oxychloride, formaldehyde, antimony chloride, and ferric chloride are also given in the abstract. E. W. W.

**Estimation of Caffeine.** WILLIAM A. PUCKNER (*Pharm. Rev.*, 1905, 23, 305—309).—When recovering caffeine from a chloroform solution, equally correct results are obtained by evaporating the chloroform from a shallow dish at a temperature of 50—60° and drying the residue at the same temperature for a further twenty-four hours, or by distilling off the solvent and drying the residue at 95—100° for about two hours. If the chloroform is distilled slowly and in such a way that active ebullition does not occur, decrepitation of the residue will not take place. W. P. S.

**Use of Titanium Trichloride in Volumetric Analysis. II.** EDMUND KNECHT and EVA HIBBERT (*Ber.*, 1905, 38, 3318—3326. Compare Abstr., 1903, ii, 509).—Coloured substances which yield colourless leuco-compounds may be readily titrated by means of a solution of titanium trichloride, the dye itself acting as indicator. All operations must be conducted in an atmosphere of carbon dioxide or other non-oxidising gas. Good results have been obtained with indigotindisulphonic acid in presence of Rochelle salt. With indigos of low grade, it is necessary first to remove impurities by Grossmann's method. Eosin A and Rhodamine B yield good results in the presence of Rochelle salt and alcohol. Pararosaniline hydrochloride, pararosanilinetrisulphonic acid, malachite-green, crystal-violet, toluasafranine, indoin, and methylene-blue have also been analysed. Hydrogen peroxide may be estimated volumetrically by means of titanium trichloride, the disappearance of the yellow colour being taken as the end-point. Ammonium persulphate solutions may be estimated by adding an excess of titanium trichloride and titrating this excess with ferric salts.

Tin may be estimated by solution in hydrochloric acid, addition of an excess of ferric salt, and titration of the excess with titanium trichloride. J. J. S.

**Estimation of Urinary Indican by Meisling's Colorimeter.** H. P. T. OERUM (*Zeit. physiol. Chem.*, 1905, 45, 459—465. Compare Abstr., 1904, ii, 449).—Bouma's isatin method is used, namely, condensation of indoxyl and isatin to indigo-red, and colorimetric estimation in chloroform solution. The method gives good results.

W. D. H.



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 Géase.  
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 Guanase.  
 Gynocardase.  
 Hæmase.  
 Invertin.  
 Lactase.  
 Lactolase.  
 Lienoprotease.  
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 Maltase.  
 Malt oxydase.  
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- the ereptic power of, as a measure of functional capacity (VERNON), A., ii, 841.
- condition of water in (DU BOIS REYMOND), A., ii, 100.
- action of acids and alkalis on the staining reactions of (BETHE), A., ii, 468.
- the silver reaction in (MACALLUM), A., ii, 736.
- conjunctive, affinity of colouring matters for (CURTIS and LEMOULT), A., ii, 600.
- intra-muscular, rate of absorption from (MEITZER and AUER), A., ii, 181.
- nervous and muscular, heat value of, in guinea pigs of different ages (TRIBOT), A., ii, 542.
- vegetable. See Vegetable tissues.
- Titanic acid**. See under Titanium.
- Titanite** from Urotrva, Transylvania (NICOLAU), A., ii, 599.
- Titanium** (STÄHLER), A., ii, 40; (STÄHLER and WIRTHWEIN), A., ii, 595.
- enhanced lines of, in the Fraunhoferic spectrum (LOCKYER and BAXANDALL), A., ii, 69.
- Titanium ammonio-compounds** (STÄHLER), A., ii, 596.
- Titanium trichloride**, action of, on organic hydroxyl compounds (ROSENHEIM and SCHNABEL), A., i, 731.
- use of, in volumetric analysis (KNECHT and HIBBERT), A., ii, 872.
- trihaloids*, hydrates of (STÄHLER), A., ii, 40; (STÄHLER and WIRTHWEIN), A., ii, 595.
- oxide, separation of, from columbium oxide (HALL and SMITH), A., ii, 829.
- Titanic acid**, estimation of, in plant ash and soils (PILLET and FRIBOURG), A., ii, 862.
- estimation of, in minerals (TRUCHOT), A., ii, 614.
- Metatitanic acid**, hydrated, action of silicon and tungsten on (TAMMANN), A., ii, 256.
- Titanium sesquisulphate** and its sulphuric acid, and double salts, with ammonium and rubidium sulphates (STÄHLER), A., ii, 595.
- Titanous sulphate**, electrolytic preparation of (EVANS), A., ii, 169.
- Titanium organic compounds** (STÄHLER), A., ii, 596.
- Titanium**, estimation of zirconium in presence of, especially in rocks (DITTRICH and POHL), A., ii, 287.
- Titanium steels**, constitution and properties of (GUILLET), A., ii, 527.
- Titanolime** from Val Malenco, Lombardy (BRUNATELLI), A., ii, 176.
- Titanous sulphate**. See under Titanium.
- Tobacco**, formation of formaldehyde in the combustion of (TRILLAT), A., ii, 53.
- Deli (HISSINK), A., ii, 414.
- Tobaccos**, apparatus for determining the differences shown by, when smoked (TÓTH), A., ii, 216.
- Tobacco oil**, composition and chemical and physical properties of (AMPOLA and SCUTTI), A., ii, 214.
- Tobacco plant**, fertilising principles required by the (GHEARD and ROUSSEAU), A., ii, 345.
- m-Tolacylnaphthalimidine* and its isomide (WIECHOWSKI), A., i, 798.



(*Tolyl compounds, Me = 1.*)

- Tolane** picrate (BRUNI and TORNANI), A., i, 270.  
*tetrachloro-, dibromide, quinone of, and its  $\psi$ -chloride* (ZINCKE and WAGNER), A., i, 343.  
*tetrachloro-p-dihydroxy-, and its dibromide and chlorobromide and their acetates, and quinhydrone* (ZINCKE and WAGNER), A., i, 342.  
*di-p-hydroxy-, and its diacetyl derivative* (ZINCKE and MÜNCH), A., i, 56.  
*o-Tolualdehyde, p-chloro-, and its semicarbazone* (AUWERS and KEIL), A., i, 445.  
*p-Tolualdehyde diacetate* (CHAUSSNER), A., i, 791.  
*p-Tolualdehydephenylhydrazone* (LAW and PERKIN), A., i, 40.  
*Tolualdehydesemicarbazones, o- and p-* (LAW and PERKIN), A., i, 40.  
**Toluene**, electrolytic oxidation of (LAW and PERKIN), A., i, 40.  
 latent heat of evaporation of (BROWN), T., 267 ; P., 75.  
 action of acetylene tetrabromide and aluminium chloride on (LAVAUX), A., i, 640.  
 condensation of, with benzaldehyde (KLIEGL), A., i, 186.  
 action of chlorine on boiling (COHEN, DAWSON, and CROSLAND), T., 1034 ; P., 211.  
 condensation of, with diphenic anhydride (PICK), A., i, 68.  
 action of methylene chloride and aluminium chloride on (LAVAUX), A., i, 43.  
**Toluene**, amino-. See Toluidines.  
*diamino-*. See 2:4-Tolylendiamine.  
*2:4:5-triamino-, brown sulphur dye from* (KALLE & Co.), A., i, 540.  
*2-bromo-3:5-dinitro- and 3:5-dinitro-2-nitroamino-, and its salts* (ZINCKE and MALKOMESIUŠ), A., i, 487.  
*3:5-dihydroxy-*. See Orcinol.  
*3-iodo-6-nitro- and 6-iodo-3-nitro-* (ARTMANN), A., i, 879.  
*m- and p-iodoxy-, compounds of, with mercuric bromide and chloride, and p-nitro-, compound of, with mercuric chloride* (MASCARELLI), A., i, 869.  
*o-nitro-, purification of* (FARBWERKE VORM. MEISTER, LUCIUS, & BRÜNING), A., i, 639.  
 examination of, for the presence of small quantities of *p*-nitrotoluene (HOLLEMAN and JUNGUS), A., ii, 864.  
*3:5-dinitro-4-nitroamino-, and its silver salt* (ZINCKE and KUCHENBECKER), A., i, 488.

(*Tolyl compounds, Me = 1.*)

- Toluenazo-**. See also Tolyazo-.  
*p-Toluenazodiethylaniline and its additive salts* (GNEHM and BAUER), A., i, 831.  
*m-Toluenazo- $\beta$ -naphthol,  $\omega$ -hydroxy-* (LANGGUTH), A., i, 593.  
*p-Toluenazophenol, o- and m-nitro-, and the acetyl compound of the m-nitro-* (HEWITT and MITCHELL), T., 231 ; P., 61.  
**Toluenediazoimide, 3:5-dinitro-** (ZINCKE and MALKOMESIUŠ), A., i, 487.  
*o-Toluenesulphanilide* (ULLMANN and LEHNER), A., i, 290.  
*m-Toluenesulphinic acid and its salts* (TRÖGER and HILLE), A., i, 336.  
*p-Toluenesulphinic acid, mercuric salt* (PETERS), A., i, 640.  
**Toluene-2-sulpho-alanine, -glycine, and -glutamic acid, 4-nitro-** (SIEGFRIED), A., i, 59.  
**Toluenesulphonacetic acids**, amides, nitriles, and thioamides of, and the chloro- and bromo-derivatives of the para-amide (TRÖGER and HILLE), A., i, 336.  
**Toluene-p-sulphonalkylamides and 2-nitro-** (CHATTAWAY), T., 159.  
**Toluene-o- and -p-sulphonamides**, separation of (BARGE & GIVANDAN), A., i, 124.  
**Toluenesulphonethenylaminooximes, o- and p-** (TRÖGER and VOLKMER), A., i, 356.  
**Toluene-o- and -p-sulphon-halogen- and -alkylhalogen-amides and 2-nitro-derivatives of the p-compounds** (CHATTAWAY), T., 151 ; P., 7.  
**Toluene- $\omega$ -sulphonic acid, o-chloro-m-nitro-, and its sodium salt** (FARBWERKE VORM. MEISTER, LUCIUS, and BRÜNING), A., i, 124.  
*p-Tolylsulphonphenyloxamide p-tolylsulphonate and its acetyl and m-nitro-derivatives* (REVERDIN and DRESEL), A., i, 51.  
*o-Toluenesulphonyl bromide and chloride, preparation of* (ULLMANN and LEHNER), A., i, 289.  
**Toluene-p-sulphonylaminobenzeneazo- $\beta$ -naphthol** (MORGAN and MICKLETHWAIT), T., 1305.  
**Toluene-p-sulphonyl-p-nitroaniline** (MORGAN and MICKLETHWAIT), T., 1303.  
**Toluene-p-sulphonyl-p-phenylenediamine and its derivatives** (WILLSTÄTTER and PFANNENSTIEL), A., i, 669.  
 and its diazotisation (MORGAN and MICKLETHWAIT), T., 1303 ; P., 222.

(*Tolyl compounds, Me = 1.*)

*m*-Toluic acid,  $\alpha$ -hydroxy-, and its nitrile (LANGGUTH), A., i, 593.

Toluidilacetonedicarboxylic acids, *o*-, *m*-, and *p*-, and their amides and imides (SCHROETER and STASSEN), A., i, 820.

*o*-Toluidine, preparation of pure, and a method for ascertaining its purity (HOLLEMAN), A., i, 272.

influence of temperature on the action of acetyl thiocyanate on (DORAN and DIXON), T., 338 ; P., 77.

action of ethyl chloroacetate on the magnesium halogen compound of (BODROUX), A., i, 643.

4-nitro-, bromination of (MORGAN and CLAYTON), T., 951.

*p*-Toluidine, freezing points of mixtures of, with the dihydric phenols (PHILIP and SMITH), T., 1735 ; P., 255.

detection of small quantities of (HOLLEMAN), A., i, 272.

Toluidines, 2- and 3-, 5- and 6-iodo-derivatives of (ARTMANN), A., i, 878.

*o*- and *p*-, formyl derivatives, crystalline liquid modifications of (ORLOFF), A., i, 643.

hydrochlorides, double salts with palladous bromides and chlorides (GUTHIER), A., i, 584.

*o*-, *m*-, and *p*-, diazoamino-compounds from (VIGNON and SIMONET), A., i, 397.

4-*p*-Toluidinoalizarin 2-methyl ether (FARBWERKE VORM. MEISTER, LUCIUS, & BRÜNING), A., i, 709.

*p*-Toluidinobenzylacetphenone (MAYER), A., i, 214.

*m*-Toluidinocarballylic acid (SCHROETER and STASSEN), A., i, 820.

Toluidinodiphenylmethanes, *o*- and *p*-, and their hydrochlorides (BUSCH and RINCK), A., i, 519.

*o*-Toluidinoformaldehydesulphoxylic acid, sodium salt (REINHARDT, DEHNEL, and LABHARDT), A., i, 261.

9-Tolunaphthazine. See 9-Methyl- $\alpha\beta$ -naphthaphenazine.

*p*-Toluenonitrile, reduction of (FRÉBAULT), A., i, 437.

3-amino-, acyl derivatives of, and 3-nitro- (BOBERT and HOFFMAN), A., i, 891.

*p*-Toluoxyacetic acid and its ethyl ester (MARGUERY), A., i, 527.

*p*-Toluoxy-*o*-benzoic acid, isomeric methyl esters (MEYER), A., i, 134.

4-*p*-Toluoxyfluorenone and its phenylhydrazone (PICK), A., i, 68.

(*Tolyl compounds, Me = 1.*)

*p*-Toluquinol, 5-bromo-3-amino-, and its acetyl derivatives and *mono*- and *di*-bromonitro- (ZINCKE and EMMERICH), A., i, 880.

$\psi$ -Toluquinol, 3:6-dichloro-5-bromo-2-hydroxy- (ZINCKE and BUFF), A., i, 881.

*p*-Toluquinone, bromonitro-derivatives (ZINCKE and EMMERICH), A., i, 879.

Tolyl methyl ethers, *o*-, *m*-, and *p*-, dielectric constants of, dissolved in benzene and *m*-xylene (PHILIP and HAYNES), T., 1002 ; P., 200.

*o*-Tolylazoformaldoxime (BUSCH and WOLBRING), A., i, 494.

Tolylazo-. See also Toluenazo-.

Tolylbisdinaphthaxanthen, *m*-amino- (ROBYN), A., i, 608.

Tolylcamphoformeneamine, *o*-nitro- (TINGLE and HOFFMANN), A., i, 800.

*p*-Tolylcamphoformeneamine and its acetyl derivative and carboxylic acid and its *p*-toluidine salt (TINGLE and HOFFMANN), A., i, 799.

*m*-Tolylcamphoformeneaminecarboxylic acid and its *m*-toluidine salt (TINGLE and HOFFMANN), A., i, 799.

Tolylcarbamic hydrazides, *o*- and *p*-, and their hydrochlorides and acetone, acetophenone, and *o*-hydroxybenzylidene compounds (BORSCHKE), A., i, 306.

Tolylcarbamides, introduction of iodine into (ARTMANN), A., i, 878.

*o*-Tolylcarbinol, alkyl ethers of (FARBENFABRIKEN VORM. F. BAYER & Co.), A., i, 128.

*p*-Tolyltrichloromethylcarbinol and its acetate and benzoate (DINESMANN), A., i, 645.

*o*-Tolyltrimethylcarbinol (KAY and PERKIN), T., 1071.

*m*-Tolyltrimethylcarbinol (PERKIN and TATTERSALL), T., 1090.

*p*-Tolyltrimethylcarbinol and its phenylurethane (PERKIN and PICKLES), T., 552.

Tolylidinaphthaxanthen, *o*- and *p*-amino- (ROBYN), A., i, 608.

2:4-Tolylenediamine and its acyl derivatives and 5-bromo- (MORGAN and CLAYTON), T., 949.

*N*-bistoluene-*p*-sulphonyl derivative (OEHLER), A., i, 829.

4:4'-oxalyl derivative (FARBWERKE VORM. MEISTER, LUCIUS, & BRÜNING), A., i, 249.

5-nitro-, azo-derivatives of (MORGAN and WOOTTON), T., 940 ; P., 179.

Tolylenedimethyldiamine. See Dimethyltolylenediamine.

(*Tolyl compounds, Me = 1.*)

- 1:2:4-Tolylenedisulphonacetoneitrile** (TRÖGER and HILLE), A., i, 337.
- Tolyethyl alcohols, o- and p-, and their phenylurethanes** (GRIGNARD), A., i, 594.
- o-Tolyglycinoacetic acid**, preparation of (DE MOULPIED), T., 440; P., 63.
- Tolyglycollic acids.** See Tolyloxy-acetic acids.
- p-Tolyhydrizinoaminomethylenecarboxylic acid**, ethyl ester and amide (BOWACK and LAPWORTH), T., 1865.
- p-Tolyhydrizinohalogenmethylenecarboxylic acids**, ethyl esters (BOWACK and LAPWORTH), T., 1863.
- p-Tolyldenehydrazine**, benzoyl derivative, silver compound of (STOLLÉ and MÜNCH), A., i, 94.
- o-Tolylimino-p-tolyl-p-tolotriazine** (BUSCH and BERGMANN), A., i, 309.
- 3-p-Tolyl-6-methyl-3:4-dihydro- $\beta$ -phenotriazine** and its salts (v. WALTHER and BAMBERG), A., i, 299.
- m-Tolyl methyl ketone**, condensation of, with naphthalaldehydic acid (WIECHOWSKI), A., i, 707.
- Tolyl-2-methylpiperidide**, dibromo- (HILDEBRANDT), A., i, 155.
- 1-Tolyl-5-methylpyrazoles, o- and p-, 3-chloro-, and their methiodides** (MICHAELIS and BEHRENS), A., i, 380.
- 1-p-Tolyl-3-methylpyrazole-4-azobenzene** and its 5-chloro-, 5-nitro-, 5-thio-, 5-thioalkyl, 5-phenylsulphone, and 5-thiobenzoate derivatives, and 5-sulphide (MICHAELIS, LEONHARDT, and WAHLE), A., i, 395.
- 1-p-Tolyl-5-methylpyrazole-4-azobenzene, 3-chloro-** (MICHAELIS and BEHRENS), A., i, 397.
- 1-p-Tolyl-3-methylpyrazole-4-p-azotoluene** and its 5-chloro- and 5-thio-derivatives (MICHAELIS, LEONHARDT, and WAHLE), A., i, 395.
- 1-Tolyl-5-methyl-3-pyrazolones, o- and p-, and their salts, benzoyl, and benzylidene derivatives** (MICHAELIS and BEHRENS), A., i, 380.
- Tolyl-5-methyl-3-pyrazolone-4-azobenzene, 1-o- and p-, and their salts and benzenesulphonyl derivatives** (MICHAELIS and BEHRENS), A., i, 396.
- 1-Tolyl-2-methylpyrrolidone-2-carboxylic acids, o-, m-, and p-, and their esters, salts, amides, aminoximes, and nitriles** (KÜHLING and FALK), A., i, 372.
- p-Tolyl-6-methylquinolyl-8-iodonium hydroxide** and their salts (WILLGERODT), A., i, 548.

(*Tolyl compounds, Me = 1.*)

- m-Tolyl naphthalidomethyl ketone** and its pseudo-acid, oxime, and phenylhydrazine (WIECHOWSKI), A., i, 708.
- Tolynaphthalimides, o-, m-, and p-** (BARGELLINI), A., i, 210.
- p-Tolynaphthylamine-8-sulphonic acid** (AKTIEN-GESELLSCHAFT FÜR ANILIN-FABRIKATION), A., i, 717.
- 1-p-Tolynaphthylamine-6- and -7-sulphonic acids** (AKTIEN-GESELLSCHAFT FÜR ANILIN-FABRIKATION), A., i, 770.
- Tolylisnitroacetoneitriles, o-, m-, and p-, sodium derivatives** (WISLIGENUS and WREN), A., i, 284.
- p-Tolyl-m-nitrobenzaloxime** (PLANCHER and PICCININI), A., i, 706.
- Tolylnitromethanes, o-, m-, and p-** (WISLIGENUS and WREN), A., i, 284.
- Tolyloxyacetic acids (tolyglycollic acids)** o-, m-, and p-, nitro-derivatives of, and 3-amino- of the para-acid (KERNOT), A., i, 286.
- Tolyloxybenzoic acids, o- and p-** (AKTIEN-GESELLSCHAFT FÜR ANILIN-FABRIKATION), A., i, 789.
- Tolyloxybenzoic acids, o-, m-, and p-** (ÜLLMANN and ZLOKASOFF), A., i, 597.
- $\alpha$ -p-Tolyloxycinnamic acid** and the action of heat on (STOERMER and BIESENBACH), A., i, 525.
- $\alpha$ -p-Tolyloxy- $\beta$ -phenylhydraerylic acid** (STOERMER and BIESENBACH), A., i, 525.
- p-Tolyloxystyrene** (STOERMER and BIESENBACH), A., i, 525.
- p-Tolylphenyl-1:3:4-oxadiazole** and its silver nitrate derivative (STOLLÉ and MÜNCH), A., i, 95.
- 3-Tolylpyrines, o- and p-, and their hydrochlorides and picrates** (MICHAELIS and BEHRENS), A., i, 380.
- 3-o- and -p-Tolylrhodanic acids** and their condensation with aldehydes (ANDREASCH and ZIPSER), A., i, 931; (STUCHETZ), A., i, 933.
- m-Tolylsemicarbazide**, preparation of (FARBENFABRIKEN VORM. F. BAYER & Co.), A., i, 383, 949.
- Tolylsulphon-**. See Toluene-sulphon-.
- 2-o-Tolylthiocarbamidoazo-p-toluene** (BUSCH and BERGMANN), A., i, 309.
- 3-Tolylthiopyrines, o- and p-, and their methiodides** (MICHAELIS and BEHRENS), A., i, 380.
- p-Tolylthiosalicyclic acid**, new preparation of (GOLDBERG), A., i, 59.
- 1-p-Tolyl-1:2:3-triazole, 5-hydroxy-, and its 4-carboxylic acid** (DIMROTH and STAHL), A., i, 385.



(*Tolyl compounds, Me = 1.*)

- 1-*p*-Tolyl-1:2:3-triazole-4-carboxylic acid**, 5-hydroxy-, ethyl ester, and its amine salts (DIMROTH and STAHL), A., i, 385.
- 1-*p*-Tolyl-5-triazolone-4-carboxylic acid** and its ethyl ester (DIMROTH and STAHL), A., i, 385.
- Tomatoes**, red colouring matters of (MONTANARI), A., i, 293.
- Tombs**, Egyptian, metals found in (BERTHELOT), A., ii, 164.
- Topaz**, alteration product of (KREJČI), A., ii, 177.
- Toxic action** and chemical combination as exemplified in hæmolytic sera (MUIR and BROWNING), A., ii, 107.
- Toxicity** of the normal intestinal contents (MAGNUS-ALSLEBEN), A., ii, 746.
- Toxicological investigations**, destruction of organic matters in (GRIGORÉEFF), A., ii, 354.
- Toxicology**, estimation of arsenic in (MAI), A., ii, 763.
- Toxin-antitoxin reaction**, physical chemistry of the (CRAW), A., ii, 747.
- Toxins** and anti-toxins (ARRHENIUS and MADSEN), A., ii, 50; (MADSEN and WALBUM; MADSEN and NOGUCHI; MADSEN), A., ii, 407. action of (HENRI), A., ii, 237. absorption theory of the neutralisation of, and related phenomena (BILTZ, MUCH, and SIEBERT), A., i, 495. action of chemical oxydases on (BAUDRAN), A., ii, 632. cholera. See under Cholera. diphtheritic and tetanic, action of calcium permanganate on (BAUDRAN), A., ii, 407. See also Tuberculin.
- Tragacanth** and acacia, comparative viscosity of the simple and mixed mucilages (WHITE), A., i, 685.
- Transition points**. See under Thermochemistry.
- Transport numbers**. See under Electrochemistry.
- Trees**, evergreen, carbohydrate reserves of (LECLERC DU SABLON), A., ii, 605.
- Trehalase**, presence of, in Fungi (BOURQUELOT and HÉRISSEY), A., ii, 113.
- Tremors**, action of formic acid on (CLÉMENT), A., ii, 408.
- Triacetic acid**, lactone of, and its phenylhydrazones and *O*-ethers and bromo- and its *O*-methyl ether (TAMBURELLO), A., i, 258.
- Triacetin**, action of hydrogen bromide or hydrogen chloride on (ACÉSAI), A., i, 7.
- Trialkylaminoguanidines**, preparation of (BUSCH), A., i, 307.
- Trialkylbarbituric acids**, imino- (CONRAD and ZART), A., i, 752.
- Trianilino-bromo- and -chloro-dimaleic anhydride dianils** (SALMONY and SIMONIS), A., i, 632.
- Trianisylcarbinols**, *m*- and *p*-, and their salts (v. BAAYER), A., i, 358.
- 1:2:4-Triazole**, alkyl derivatives of (PELLIZZARI and SOLDI), A., i, 672.
- Triazoles**, *endoimino*- (MERCK), A., i, 949.
- Triboluminescence** (TSCHUGAEFF), A., ii, 132; (GUINCHANT), A., ii, 366; (GERNEZ), A., ii, 430, 431; (WEBSTER), A., ii, 786. and crystalloluminescence (TRAUTZ and SCHORIGIN), A., ii, 494; (TRAUTZ), A., ii, 662. in the acridine series (MORGAN), A., ii, 786.
- Tricarballoylanilic acid**, esters and anilide of (BERTRAM), A., i, 466.
- Tricarballoylic acid** and cyano-, dimethyl ethyl ester (KNOEVENAGEL and MOTTEK), A., i, 61.
- Tricarballoylmonoanilidic acid**, aniline salt (BERTRAM), A., i, 466.
- Tri-*p*-chlorobenzoyladrenaline** (STOLZ), A., i, 106.
- Tricyanocarbamide** and its trisodium salt (HANTZSCH, BAUER, and HOFMANN), A., i, 330; (HANTZSCH), A., i, 331.
- Tricyanotricarboxylic acid**, ethyl ester (HANTZSCH and BAUER), A., i, 330.
- Tridecoic acid**,  $\alpha$ -bromo- and  $\alpha$ -hydroxy- (LE SUEUR), T., 1905.
- Tridecoic aldehyde** and its polymeride, oxime, and semicarbazone (LE SUEUR), T., 1903.
- Tridecyl alcohol**, Tridecylamine and its salts, and Tridecylcarbamic acid, methyl ester (KLARFELD), A., i, 166.
- Tridecyl cyanide**,  $\alpha$ -hydroxy-, and its hydrolysis (LE SUEUR), T., 1904.
- 2:4:6-Tridinaphaxanthylbenzene**, 1:3:5-trihydroxy-, and its triacetyl derivative (FOSSE and ROBYN), A., i, 607.
- Triethylbenzene**, aluminium chloride compound, combination of, with hydrogen chloride and with triisopropylbenzene hydrochloride (GUSTAVSON), A., i, 334, 697.
- 1:3:3-Triethyl-3-ethylideneindoline** and its picrate (PLANCHER and CARRASCO), A., i, 719.
- 1:3:7-Triethylxanthine**, preparation of (SCARLAT), A., i, 160.
- Triisohexylamine** and its salts (SABATIER and SENDERENS), A., i, 268.

- 1:2:3-Trimethoxybenzene, 5-hydroxy-. See Antiarol.
- 3:4-Trimethoxy-benzylamine and its sulphate and platinichloride and -benzylmethylamine (HEFFTER and CAPELLMANN), A., i, 877.
- 3:3':4'-Trimethoxybenzylidenecoumaranone (BLOM and TAMBOR), A., i, 916.
- Trimethoxybenzyltrimethylammonium salts (HEFFTER and CAPELLMANN), A., i, 878.
- 3:4:4'-Trimethoxychalkone and its acetyl derivative (v. KOSTANECKI and NITKOWSKI), A., i, 915.
- 4:3':4'-Trimethoxychalkone, 2'-hydroxy-, and its acetyl derivative (v. KOSTANECKI and SCHREIBER), A., i, 808.
- 3:3':4'-Trimethoxy-flavanone and *iso*-nitroso-, and -flavonol and its sodium and acetyl derivatives (v. KOSTANECKI and NITKOWSKI), A., i, 915.
- 5:7:4-Trimethoxy-flavanone, 3:6:8-*tri*-bromo-, and -flavone, 6:8-*di*bromo- (BREGER and v. KOSTANECKI), A., i, 366.
- 7:8:4'-Trimethoxy-flavanone and *iso*-nitroso-, and -flavonol and its acetyl derivative (v. KOSTANECKI and SCHREIBER), A., i, 808.
- Trimethoxyphenanthrenecarboxylic acid (KNORR and PSCHORR), A., i, 814.
- Trimethoxyvinylphenanthrene (KNORR and PSCHORR), A., i, 814.
- Trimethylacetoacetaldehyde and its copper salt (COUTURIER and VIGNON), A., i, 571.
- "Trimethyladipic acid" (NOYES and DOUGHTY), A., i, 321.
- Trimethylamine, preparation of, by the methylation of ammonia (ESCHWEILER; KOEPFEN), A., i, 328.
- additive compounds of (HANTZSCH and GRAF), A., i, 575.
- 1:3:5-Trimethylbenzene. See Mesitylene.
- 1:2:3-Trimethylbenziminazole-2-ol, 5-bromo- and 5-chloro-, and their iodides (FISCHER and MOUSON), A., i, 246.
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# ERRATA.

## COLLECTIVE INDEX, 1873-1882.

Page	Col.	Line	
284	ii	19*	Smith, Edgar Francis (and with his co-workers) should be Smith, Edgar Fahs.

## COLLECTIVE INDEX, 1883-1892.

### PART I.

404	18*	Smith, Edgar Francis (and with his co-workers) should be Smith, Edgar Fahs.
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## COLLECTIVE INDEX, 1893-1902.

### PART I.

607	ii	18	Smith, Edgar Francis (and with his co-workers) should be Smith, Edgar Fahs.
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### PART I.

Page	Line	
659	11* }	for " $C_6H_9$ " read " $C_6H_4$ ."
659	2* }	

### PART II.

419	5	for "Ytterbia"	read "Ytterby."
486	22, 23,	" "Sa"	" "Sm."
536	1*	" "i, 600"	" "ii, 125."
559	8*	" "arsenamide"	" "arsenimide."
620	9* et seq.	" "pyrochlor"	" "pyrochlore."
839	19	" "400 kilos"	" "4000 kilos."

## VOL. LXXXVIII (ABSTR., 1905).

### PART I.

23	21* & 20*	delete "from Prussian blue."	
51	13	for "dinitro-p-benzoylaminophenyl benzoate"	read "dinitro-p-nitrobenzoylaminophenyl nitrobenzoate."
294	{ 13* } { 12* }	" "and also"	read "but dissolves."
399	14*	" "307"	" "311."
467	15	" "alkyl"	" "allyl."
603	7	" "1903"	" "1899."
949	17* 16*	" "endoanilinodiphenyltriazole"	read "endoanilindiphenyltriazole."
	12*	for "endoanilindiphenyltriazole"	" "endoanilodiphenyltriazole."
	8*	" "endoanilindip-tolyltriazole"	" "endoanilodip-tolyltriazole."

\* From bottom.

# ERRATA (*continued*).

## PART II.

Page	Line.		
108	5* <i>for</i>	"Rose"	<i>read</i> "Roll."
120	22* "	"Iron"	"Tin."
173	8* "	"Inst"	"Ist."
231	8* "	"THOMSON"	"THOMSEN."
601	26 "	"blood"	"fowl-."
634	8* "	"Zinc"	"Tin."
634	3* "	"zinc"	"tin."
636	25 "	"leakages"	"linkings."
Page	Col.	Line	
932	i	15* <i>for</i>	"Konsortium" <i>read</i> "Consortium."

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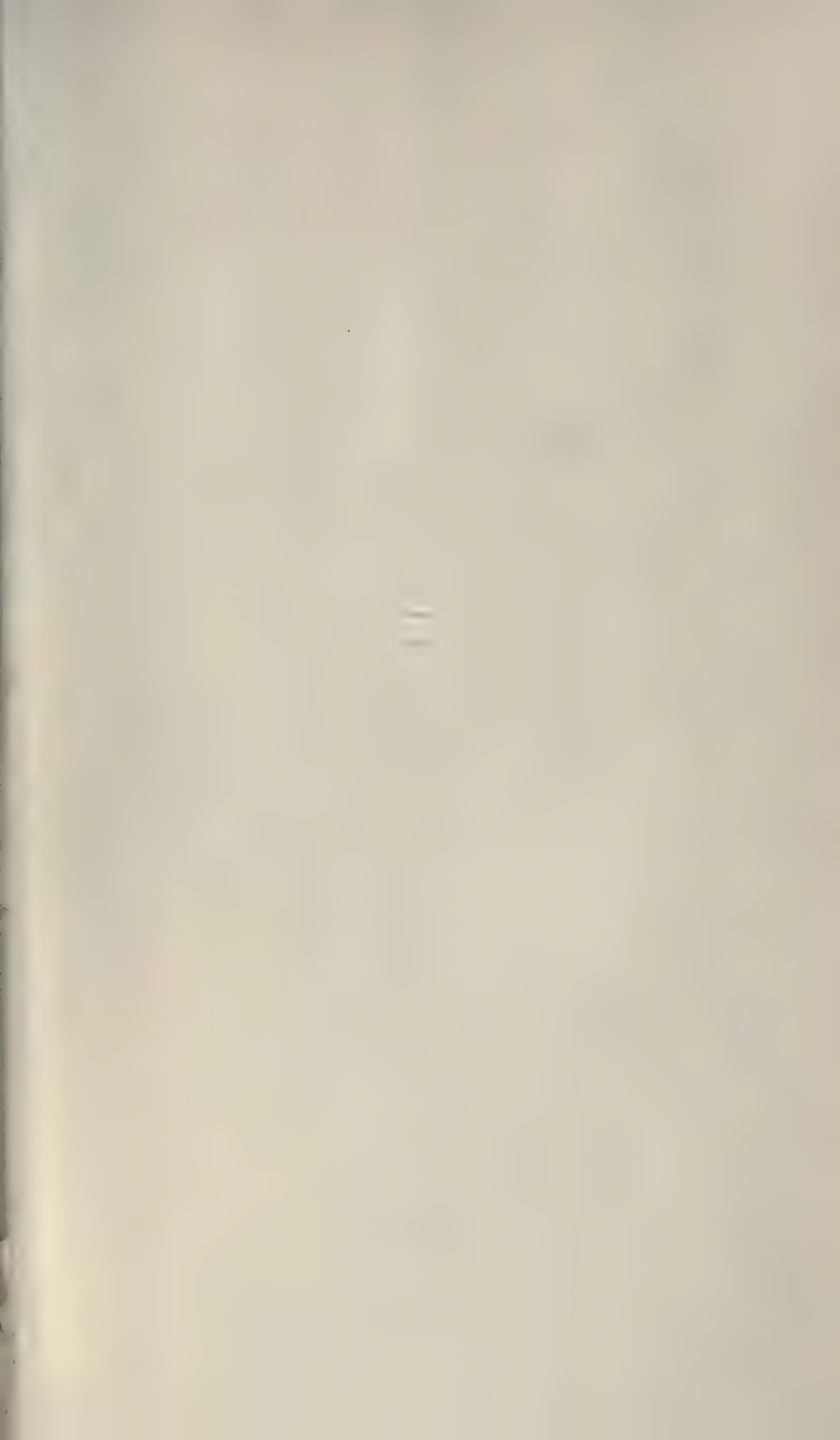
\* From bottom.

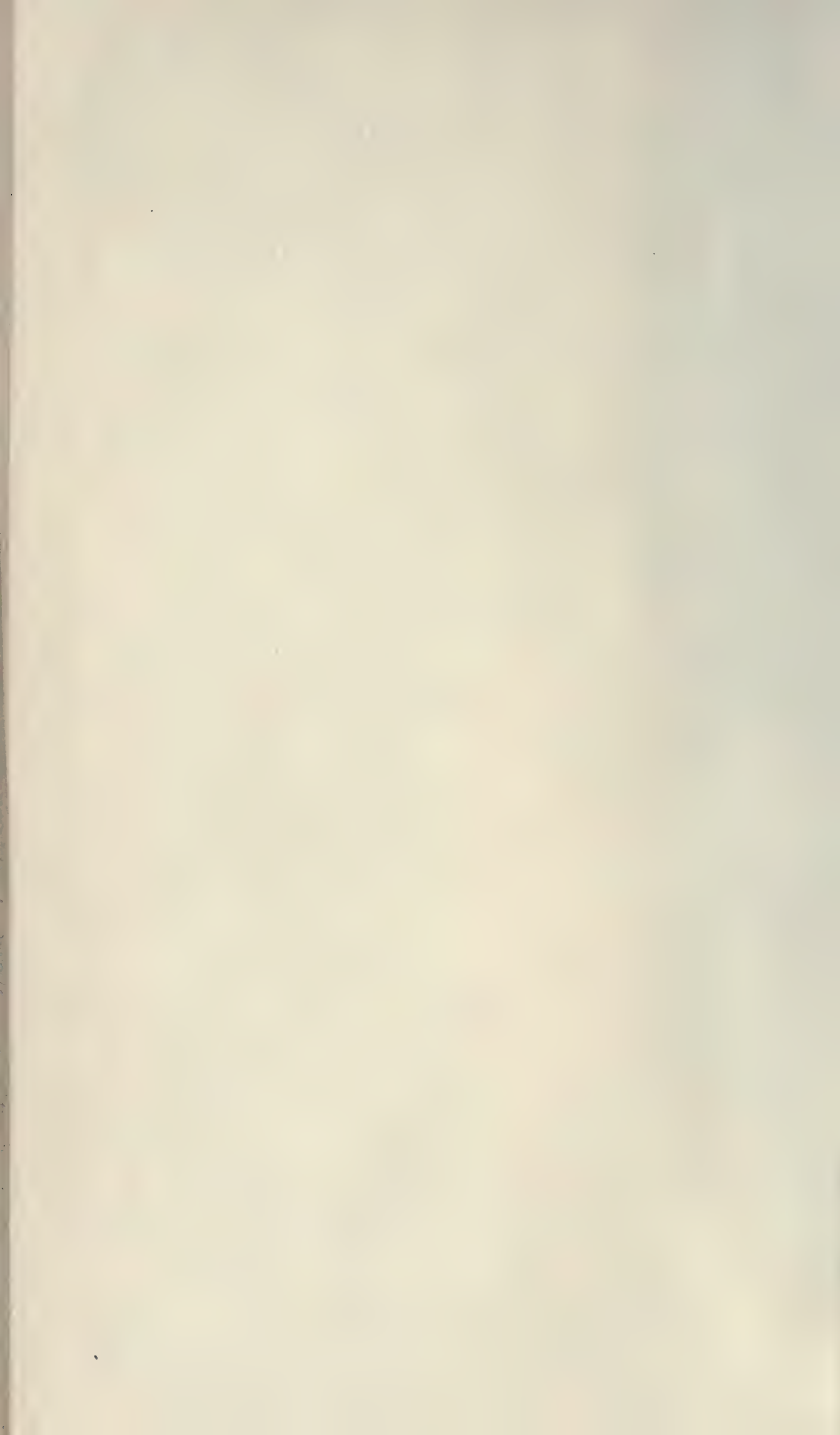
*International Atomic Weights.*

		O=16.	H=1.			O=16.	H=1.
Aluminium.....	Al	27.1	26.9	Neodymium .....	Nd	143.6	142.5
Antimony .....	Sb	120.2	119.3	Neon .....	Ne	20	19.9
Argon .....	A	39.9	39.6	Nickel.....	Ni	58.7	58.3
Arsenic .....	As	75.0	74.1	Nitrogen.....	N	14.04	13.93
Barium .....	Ba	137.4	136.4	Osmium .....	Os	191	189.6
Bismuth .....	Bi	203.5	206.9	Oxygen .....	O	16.00	15.83
Boron .....	B	11	10.9	Palladium .....	Pd	106.5	105.7
Bromine .....	Br	79.96	79.36	Phosphorus.....	P	31.0	30.77
Cadmium .....	Cd	112.4	111.6	Platinum .....	Pt	194.8	193.3
Cæsium .....	Cs	132.9	131.9	Potassium ...	K	39.15	38.85
Calcium .....	Ca	40.1	39.7	Praseodymium ...	Pr	140.5	139.4
Carbon .....	C	12.00	11.91	Radium .....	Ra	225	223.3
Cerium .....	Ce	140.25	139.2	Rhodium .....	Rh	103.0	102.2
Chlorine .....	Cl	35.45	35.13	Rubidium .....	Rb	85.5	84.9
Chromium .....	Cr	52.1	51.7	Ruthenium.....	Ru	101.7	100.9
Cobalt.....	Co	59.0	58.55	Samarium .....	Sm	150.3	149.2
Columbium .....	Cb	94	93.3	Scandium .....	Sc	44.1	43.3
Copper .....	Cu	63.6	63.1	Selenium.....	Se	79.2	78.6
Erbium .....	Er	163	164.7	Silicon.....	Si	28.4	28.2
Fluorine .....	F	19	18.9	Silver .....	Ag	107.93	107.11
Gadolinium ...	Gd	156	154.8	Sodium .....	Na	23.05	22.88
Gallium .....	Ga	70	69.5	Strontium .....	Sr	87.6	86.94
Germanium .....	Ge	72.5	72	Sulphur .....	S	32.06	31.82
Glucinum .....	Gl	9.1	9.03	Tantalum .....	Ta	183	181.6
Gold .....	Au	197.2	195.7	Tellurium .....	Te	127.6	126.6
Helium .....	He	4	4	Terbium ...	Tb	160	158.8
Hydrogen .....	H	1.008	1.000	Thallium .....	Tl	204.1	202.6
Indium .....	In	115	114.1	Thorium .....	Th	232.5	230.8
Iodine .....	I	126.97	126.01	Thulium .....	Tm	171	169.7
Iridium .....	Ir	193.0	191.5	Tin .....	Sn	119.0	118.1
Iron.....	Fe	55.9	55.5	Titanium .....	Ti	48.1	47.7
Krypton .....	Kr	81.8	81.2	Tungsten .....	W	184	182.6
Lanthanum .....	La	138.9	137.9	Uranium .....	U	238.5	236.7
Lead .....	Pb	206.9	205.35	Vanadium .....	V	51.2	50.8
Lithium .....	Li	7.03	6.98	Xenon .....	Xe	128	127
Magnesium .....	Mg	24.36	24.18	Ytterbium .....	Yb	173.0	171.7
Manganese .....	Mn	55.0	54.6	Yttrium .....	Yt	89.0	88.3
Mercury .....	Hg	200.0	198.5	Zinc.....	Zn	65.4	64.9
Molybdenum .....	Mo	96.0	95.3	Zirconium .....	Zr	90.6	89.9



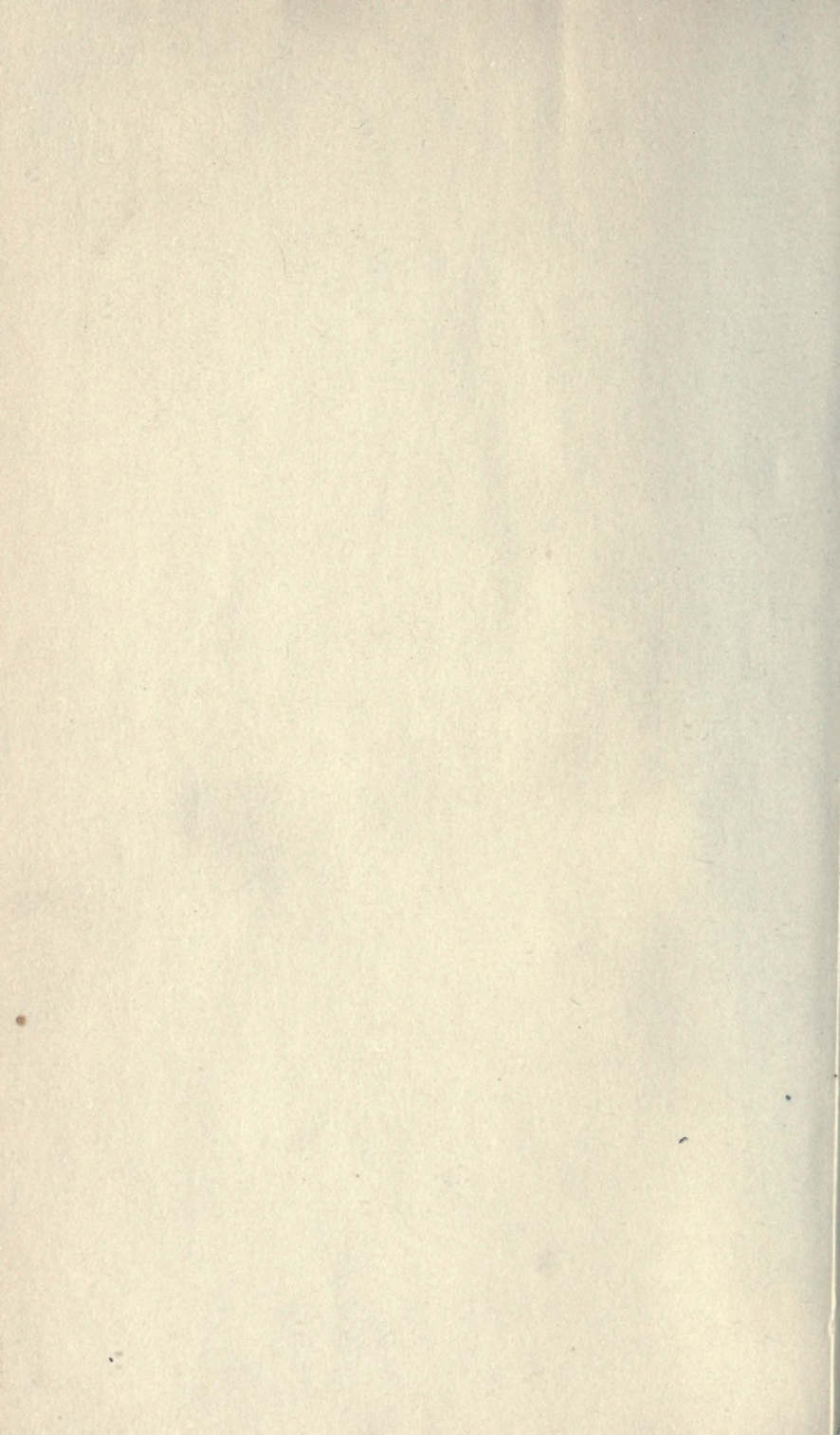












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